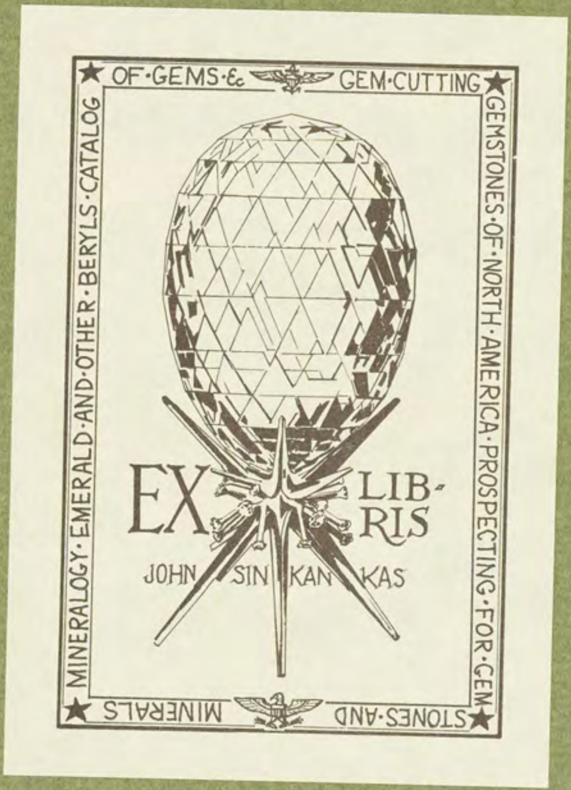
MINERALOGY·EMERALD·AND·OTHER·BERYLS·CATALOG
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BRITISH MINERALOGY:

OR

COLOURED FIGURES

INTENDED TO ELUCIDATE

THE MINERALOGY

OF

Great Britain.

BY JAMES SOWERBY, F. L. S.

HONORARY MEMBER OF THE PHYSICAL SOCIETY OF GÖTTINGEN,
DESIGNER OF ENGLISH BOTANY, AUTHOR OF ENGLISH FUNGI, ETC.

(With Assistance.)

As for the Earth, out of it cometh Bread, and under it is turned up as it were Fire. The Stones of it are the Places of Sapphires; and it hath Dust of Gold. Job xxviii. 5, 6.

VOL. III.

LONDON:
PRINTED BY
RICHARD TAYLOR AND CO., SHOE-LANE, FLEET-STREET;
And sold by the Author, J. Sowerby, at No. 2, Mead Place, Lambeth;
and by White, Fleet-street; Sherwood and Co., Pater-noster-row;
and all other Booksellers.

MDCCCIX.

March 1.1806. Publish'd by Jas Sowerby London.

TAB. CCI.

ZINCUM oxygenatum.
Oxide of Zinc, or Calamine.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 6. Zincum. *Spec.* 1. Oxygenatum.
Div. 2. Imitative.

OXIDE of Zinc, *tab.* 156, was crystallized in a shape peculiar to itself. In the present instance it occurs in the form of another substance, viz. Carbonate of Lime: see *tab.* 34. It is not a little remarkable that this oxide should thus take the place of another substance, and assume its form, so as to become what are termed secondary crystals *. They are so frequent in Oxide of Zinc as often to prove a very convenient help towards discriminating that substance, otherwise not easily characterized, from the earthy appearance it commonly assumes. It is found in Flintshire †, Derbyshire, and at Mendip in Somersetshire, as well as in several other parts of the United Kingdoms, in

* When any mineral takes the place of a crystal, either by decomposing it or taking the cast of the mould first formed by another, it is called secondary, as it is so to those formed originally by the first substance. Calamine sometimes replaces Cubic fluor, &c.

† Whence I have received good specimens from D. Pennant, Esq., son of the well-known Pennant, author of British Zoology, and the Rev. H. Davies of Beaumaris.

these shapes, mostly taking the form of Carbonate of Lime, and is often detected in the process shown in *the upper figure*. The upper surface is a smoothish Oxide of Zinc, and beneath still remains crystallized Carbonate of Lime. *In the lower figure* the Oxide of Zinc has supplanted the Carbonate of Lime, and is cellular or porous, which is one of its characters, whence it is often called bony, from its resemblance to the cellular inner part of a bone. It is sometimes white, but mostly coloured by Oxide of Iron, with various ochrey tints, and seldom has any lustre. It is procured in large quantities for the manufacture of brass, &c., and produces about thirty per cent of Zinc *.

* Zinc has been found perfectly ductile if heated to a certain temperature.

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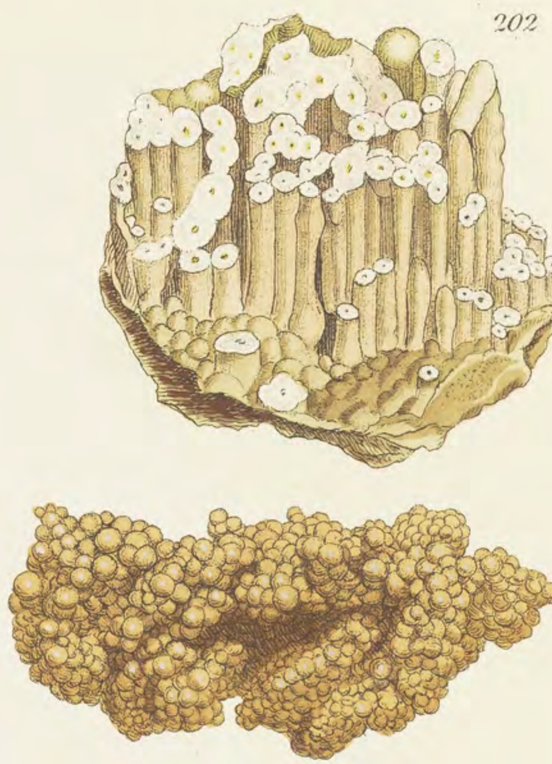

March 1.1807, Publish'd by Jas. Sowerby London.

TAB. CCII.

ZINCUM oxygenatum.

Stalactitical Oxide of Zinc, or Calamine.

Div. 2. Imitative.

SYN. Zinc oxidé concrétionné. *Haüy*, 4. 162.

CALAMINE, or Oxide of Zinc, is here truly imitative. In the present instance it much resembles *Flos-Ferri**, which, however, is generally more varied in its form. This is a rare specimen, which was presented to Sir Joseph Banks by my kind friend G. Laing, Esq., and comes from Wanlockhead mine, in Scotland.

* Flos-Ferri is well known from the Styria Iron mines, and is mostly of a fine white, and coralliform shape, like *tab.* 9, but with a surface finely covered with minute spiculated crystals, giving it a soft downy appearance. We have moderate specimens from Scotland.

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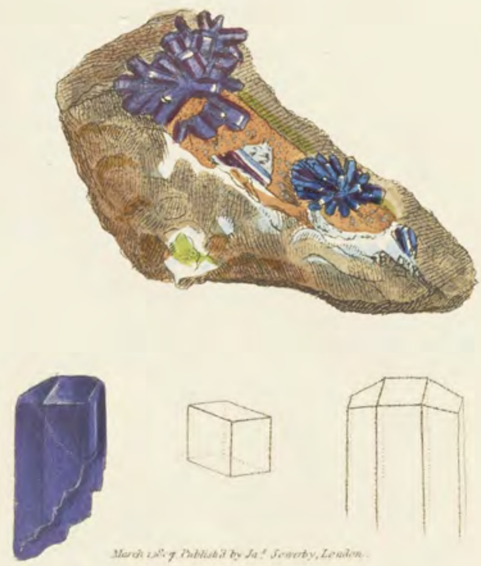

March 1.1807 Publish'd by Jas. Sowerby, London.

TAB. CCIII.

CUPRUM carbonatum.
Crystallized Blue Carbonate of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 10. Cuprum. *Spec.* 5. Carbonatum.
Div. 1. Crystallized.

SYN. Cuivre oxidé bleu. *De Born*, 2. 329.
Azure de Cuivre. *De Lisle*, 3. 541.
Kupfer lazur. *Emmerl.* 2. 246.
Blue Calciform Copper Ore. *Kirw.* 2. 129.
Cuivre carbonaté bleu. *Haüy*, 3. 562.

BLUE Carbonate of Copper has rarely been seen crystallized, especially in the present forms, and has not, I believe, been before mentioned as a native of any part of Great Britain. The present rare specimen is preserved in the cabinet of G. Laing, Esq., and comes from Wanlockhead mine. I have some beautiful specimens from Cornwall, undoubtedly of this kind, but could not be certain of their formation until compared with these.

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TAB. CCIV.

CUPRUM carbonatum.
Crystallized Green Carbonate of Copper.

Div. 1. Crystallized.

THIS came from nearly the same spot as the last, and is equally rare. The crystals are nearly the same, and only differ in being thicker, and having truncations. We are enabled to show whole crystals, as my kind correspondent sent me some that were found loose. It is always an interesting discovery in the true science of Mineralogy to find the crystals of any substance, that when thoroughly acquainted with it, we may be less at a loss to know it without analysis, so that it may often prevent the destruction of a rare specimen. We, therefore, without analysis, consider these crystals as the same with what we have less perfectly crystallized from other places, as Wales, &c.

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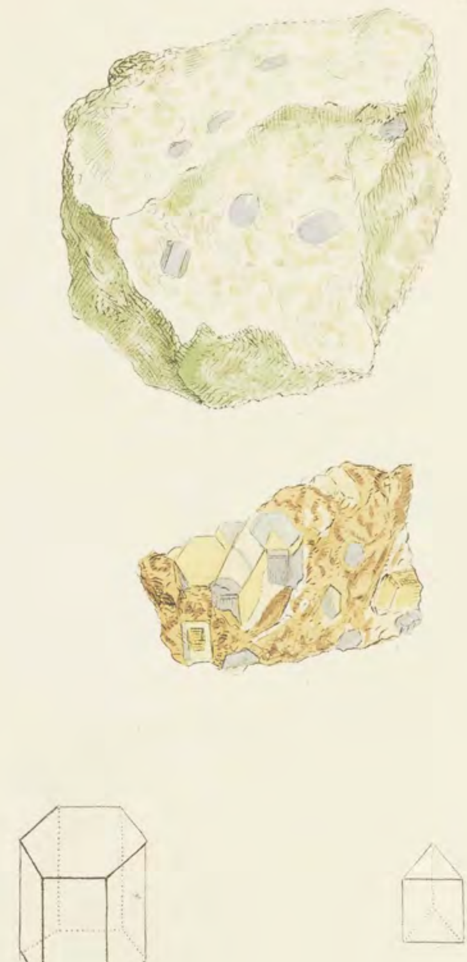

March 1.1807, Publish'd by Jas. Sowerby, London.

TAB. CCV.

CALX phosphata.

Phosphate of Lime, or Apatite.

Class 2. Earths.	*Order* 1. Homogeneous.
Gen. 3. Calx.	*Spec.* 3. Phosphata.
	Div. 1. Crystallized.

SYN. Gemeiner apatit. *Emmerl.* 1. 502.
Chaux phosphorée, Apatite. *De Born*, 1. 363.
Calx, combined with Phosphoric Acid. *Kirw.* 1. 128.
Amethyste basaltine. *De Lisle*, 2. 254.
Chaux phosphatée. *Haüy*, 2. 234.

APATITE has not long been known as a native substance of Great Britain, and I believe it has only been found at Stenna Gwyn, in Cornwall, from whence I have received it by favour of Mr. Rashleigh. In many instances the crystals are so small and so much imbedded in talcose rock as scarcely to be discernible, and it is not uncommon for the rock itself, or rather the gangue, to be thought Phosphate of Lime altogether. The present specimen was procured some years since, and is still a fine one, particularly as it shows the primitive crystal, and the nature of its fracture, which is very distinctly and neatly apparent. It

also shows some of the various tints, such as purplish, blueish and greenish, natural to it, though rather palely *.

Apatite is infusible by the blowpipe. Powdered, and thrown on red-hot coals, it emits a yellowish green phosphorescent light. It is soluble in muriatic acid, and the solution becomes gelatinous. No decomposition of the phosphoric acid from the Lime takes place. This plate shows the integrant molecule, a regular triangular prism, very distinct in the fractures of the specimen, and also the primitive hexangular prism. It has been noticed as found in Spain and Germany by most mineralogists:—In the former it constitutes large mountains.

* We have since received a fine specimen of an opaque white, and water blue, from Dr. Turton, about a quarter of an inch in length.

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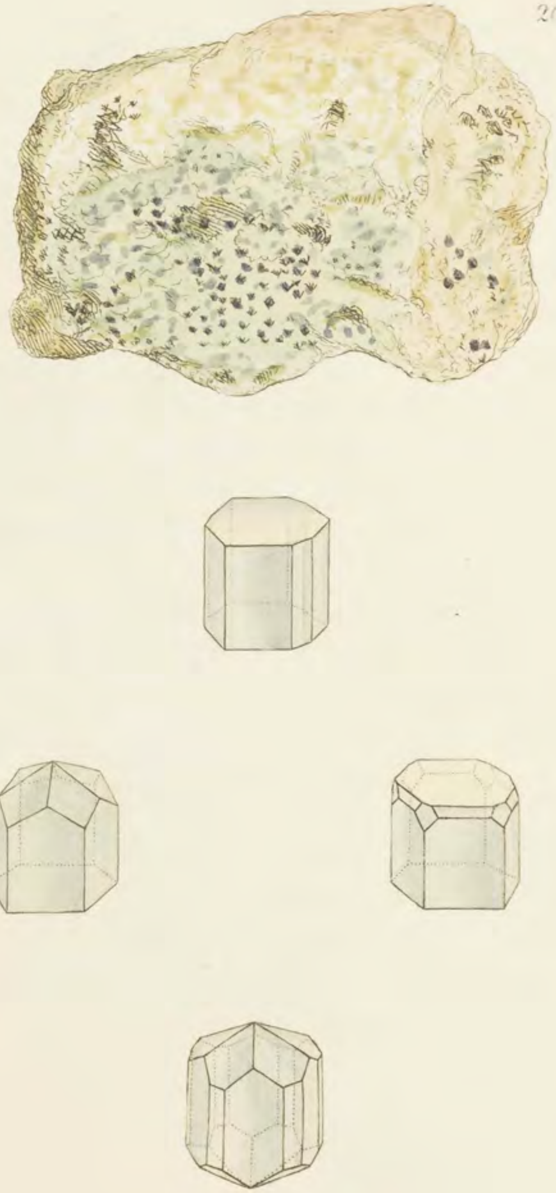

Mar. 1. 1807. Publish'd by Ja.s Sowerby Lond.

TAB. CCVI.

C A L X phosphata.
Phosphate of Lime.*

Div. 1. Crystallized.

THIS specimen shows some of the varieties in the truncations and bevillings of the hexaëdral prism, from the alternately truncated edges—see *the upper geometrical figure*—to the more complicated—see *the lower figure.*

The gangue is commonly talcose, with Oxide of Tin and with Quartz, sometimes with Fluor, Felspar, and rarely white Topaz, as in this specimen.

The prevalent quantity of Talc often gives it a waxy appearance, and this is peculiar to this rock, which, thus differing from the general appearance of rocks, has been supposed to be, and even sold for, Apatite itself.

Apatite has been confounded with Beryl by the Chemist Trommsdorf, who thought it to contain a new earth, which he named Augustite, but this is now understood to be an error.

* Phosphorus is sometimes united artificially with Lime, forming a powder, which, if put into water, sinks to the bottom, but soon decomposes the water by taking up part of its oxygen, and freeing part of the hydrogen: the phosphorus becomes inflamed; and while this decomposition is taking place, flames burst forth through the water till the phosphorus is consumed.

The upper geometrical figure shows the prism truncated on the three alternate vertical edges. *The left hand figure below* shows an hexaëdral pyramid placed on the solid angles of the prism. *The right hand figure* shows facets that are on the horizontal edges and solid angles. *The lower figure* shows both ends, forming the alternating pyramid, giving four- and six- sided facets to the prism *.

* It is remarkable that the pyramids in our crystals alternate with the faces of the prism. Haüy found them only opposite.

Nov. 1.1806. Publish'd by Ja.s Sowerby, London.

TAB. CCVII.

SILEX Quartzum.

Quartz Septarium.

Div. 2. Imitative.

Quartz is metamorphosed into so many different shapes, that we never can be aware of the varieties; and the appearance of the present specimen would by no means indicate such a substance. From its dull appearance it has generally been taken for Lead, or some other metal, as it looks as if easily flexible. The hardness and sharpness of the delicately acute edges, however, soon betray it, and the fractures, showing its crystallization, pretty readily determine it.

It seems quite natural to most Quartz to have been in solution. In this instance, having evidently formed itself in the cracks of the Clay, it is the more instructive; for whatever might have held the Quartz in solution, might, at the same time, have decomposed the Clay, which, however, must have been dry enough to have cracked, and formed sharp and neatly distinct fissures, so beautifully shown by the Quartz. But if fire had dissolved the Quartz, the Clay would have been baked: and that is not the case; as the latter, in its common state, remains in some of the fissures. This specimen is the production of Cumberland, and I have been favoured by the Rev. Mr. Harriman and Mr. Oliver with a piece about a foot in length from which the Clay had apparently been washed out, chiefly on one

side. The present specimen, however, is remarkable for the incurved structure of the Septæ.

Perhaps an attention to the nature of the subject will give a theory for the cause, or lead us nearer to the cause in question. Thus the general contrarieties of heat and cold may be the cause. Clay cracks from contraction in cold or frost, giving out much of its water into the fissures, which latter, becoming impregnated with Quartz (which may be crystallized from a saturated solution in any medium), thus retains its position, and afterwards the water may wash away the Clay under various circumstances.

I do not know whether it is pure water that forms in the cracks of frosty Clay; perhaps it may be impregnated with Quartz, whose natural temperature will not allow above a certain quantity to remain with the Clay *. This might be really of consequence enough to be inquired into by those who have the opportunity.

* Common Clay is mostly a mixture (strictly speaking) of Silex and pure Argilla, and is often so called when the Quartz contained in it amounts to sixty, or even ninety, per cent.

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[illegible] Publish'd by Jas. Sowerby London.

TAB. CCVIII.

SILEX Quartzum.

Laminated Quartz.

Div. 1. Crystallized.

THE more we become acquainted with Mineralogy, the more we have to admire.

The nuclei of crystallization often form in plates; but, in the present instance, it should seem that, by some interruption of a particular nature in the dissolving menstruum, the crystal could not be formed so smoothly and regularly as is common with crystallizing Quartz, and *tab.* 199 shows that it may be mixed with much foreign matter without altering the regularity of the crystallization. Thus the present subject is the more remarkable. This sort of Quartz has been found pretty frequently at Glassteining, in Cornwall, but I do not know that it has been found elsewhere. It has often Tin and decomposing Felspar about it; and whether these or any other decomposable substances have been originally formed with it, and have since caused its decomposition, as seems to be partly the case with the Pebbles at *tab.* 103, either way it is a curious circumstance, and may lead to some useful truth in the investigation of the

nature of Crystallography, or to some other part of mineralogical science.

These are the usual eighteen-sided crystals, interrupted in a peculiar manner.

The right hand figure is in plates a little oblique to the base of the pyramid, or to the transverse section of the column. *The middle figure* shows them still more oblique; and *the left hand one* shows the laminæ disposed lengthwise to the column, with an interruption of another set of laminæ towards the top. *The upper figure* has many other varieties.

Most of the specimens which I have received of this curious subject are by favour of that warm friend to the science of Mineralogy, Philip Rashleigh, Esq.

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May 1,1807, Publish'd by Ja^s Sowerby London.

TAB. CCIX.

ARGILLA electrica.
Tourmaline, or *Schorl.*

Class 2. Earths.	*Order* 1. Homogeneous.
Gen. 4. Argilla.	*Spec.* electrical.

SYN. Tourmaline. *Kirw.* 1. 271.
Le Schorl. *Broch.* 1. 226.
Schwarzer Schorl. *Emmerl.* 1. 95.
Tourmaline. *Haüy*, 3. 31.
Borax electricus. *Linn. Syst. Nat. ed.* 12. *t.* 3. 96.

This substance I have received from my friends Dr. Penneck and Mr. Dunkin of Penzance, found in that neighbourhood; and I have gathered some curious curvilinear varieties of it at the Logan Rock. I have also been favoured with some aggregated kinds, by the Rev. Mr. Neck, from Devonshire.

The specimen here figured was received from the former gentleman, and is somewhat remarkable for the largeness of the crystals *, though they are somewhat confused; but more so still, from one end passing by fine straight fibres into the Quartz which accompanies it, giving it an ap-

* The crystals are found more perfect at the Brazils, in Spain, Switzerland, &c.

pearance of a termination. The crystallized end is shown at *the upper part of the geometrical figure on the left hand* of the plate, and the other end on *the lower part of the same figure* in fibres.

The other figure is one out of a gangue of Mica from the neighbourhood of Aberdeen. These crystals are not very regular, but are remarkable for holding small Garnets, imbedded in them;—*see the lower figure.*

Tourmaline is by some authors said to be distinct from Schorl, whilst others consider these substances only as varieties of each other. In some instances they appear to be distinct, especially when sufficiently large; but of this more shall be said hereafter.

Tourmaline generally presents straight prisms *, mostly blackish or dark-coloured, sometimes showing a greenish or brownish colour at the transparent edges or flaws. My specimens from the Logan Rock are greenish, but those imbedded in Mica are brownish. Some foreign specimens are remarkable for varying their colour according to the direction in which they are viewed. Tourmaline is well known for its electrical properties. The crystals have mostly a rich gloss, are smoothish, with more or less numerous striæ placed longitudinally on the prism, and horizontally on the pyramids, excepting when they are approaching to fibrous, as below observed.

* Sir John St. Aubin is said to have in his possession a crystal without a prism—a great rarity.

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May 1 1807, Published by Ja.s Sowerby London.

TAB. CCX.

The present specimen is part of a large aggregated * mass sent me by the Rev. Mr. Gregor from Cornwall, and is composed of numerous crystals forming several distinct varieties, where they are not confusedly intermixed with each other. It seems to have been found in the vicinity of a red Oxide of Iron, as the colour about it indicates. In Mr. Gregor's account of the analysis (*Nicholson's Journal, vol.* 4. 312), it appears that it contains Oxide of *Titanium*. It is somewhat remarkable that the red Schorl of Siberia, and the large specimen of Rubellite or Titanite † (as it has been called) in the possession of the Right Hon. Charles Greville, are by some considered as varieties of Tourmaline.

The crystals in this specimen show many of the faces which are generally found on Tourmaline; viz. the three-sided prism, truncated at the edges, and formed into a six-sided prism; the same with two or more bevillings on the edges, &c.—The fracture is somewhat conchoidal, and the primitive form is a rhomboidal parallelopiped.

Tourmaline is harder than Quartz. With moderate heat it becomes electric, attracting and repelling ashes, &c. ‡, a

* Schorl is said to be mostly aggregated, and Tourmaline to be chiefly imbedded in single crystals.

† This was presented to Colonel Symes by the king of Ava, and is said to be worth a thousand pounds.

‡ Foreign specimens, sometimes cut and polished, are known by this property.

property said to be in Schorl, *Bergm.* 2. 124. *Kirw.* 1. 272. The latter observes that Bergman thought Lime essential to Schorl in the analysis of that of Mount Albans, which Mr. Kirwan says was probably Hornblende.

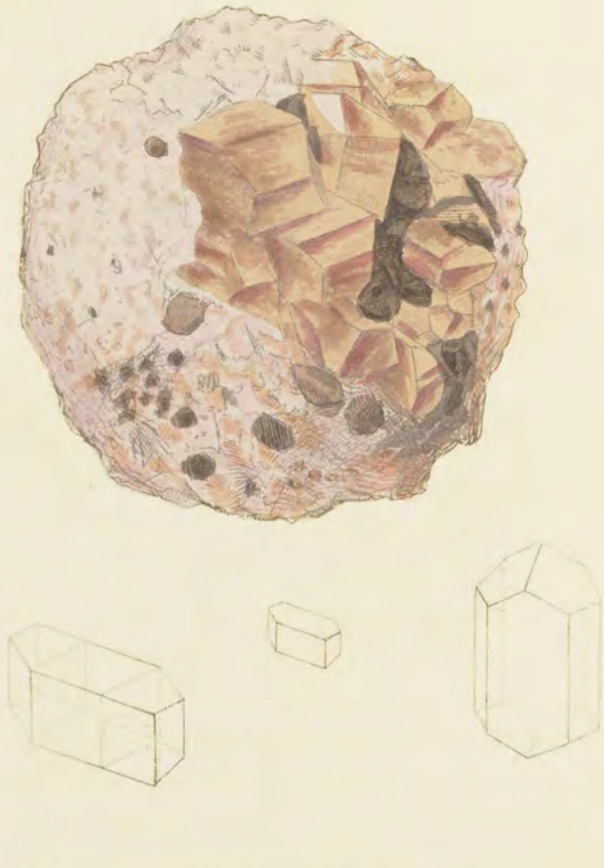
Mr. Kirwan asserts that Schorl was named so from its brittleness; others say from the village Schorlow where it was first noticed.

Analyses of Tourmalines by Bergman.

	Of Tyrol.	Of Ceylon.	Of Brazil.
Argill	42	39	50
Silex	40	37	34
Calcareous Earth	12	15	11
Iron	6	9	5
	100	100	100

Analysis of the Tourmaline of Brazil by Vauquelin.

Silex	40·00
Alumine	39·00
Lime	3·84
Oxide of Iron	12·50
Oxide of Manganese	2·00
Water	2·66
	100·00



May 1.1807. Publish'd by Jas. Sowerby London.

TAB. CCXI.

SILEX Petuntse.

Feldspar and Petuntse.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* Petuntse.
Div. 1. Crystallized.

SYN. Feldspath. *Delisle*, 2. 445. *Emmerl.* 1. 226.
Feldspar. *Kirw.* 317.
Feldspath. *Haüy*, 2. 590.
Spatum campestre. *Linn.*

Feldspar is a very common substance, chiefly found in aggregates of various descriptions. It is observable in the granites which come from Aberdeenshire to pave the principal highways in this metropolis, and remarkable in the Moor Stone of Devonshire on London and Westminter bridges, where the imbedded crystals are very bold and distinctly seen, especially after rain. The present specimen comes from near Monymusk in Aberdeenshire, by favour of my kind friend Mr. James Reid. The crystals, being nearly independent, allow us to see their determined form distinct from the gangue, which is more confused Feldspar with Quartz and dark crystallized Mica, forming a Granite. *The little middle figure* was easily detached, and makes a short six-sided prism. I have put a geometrical

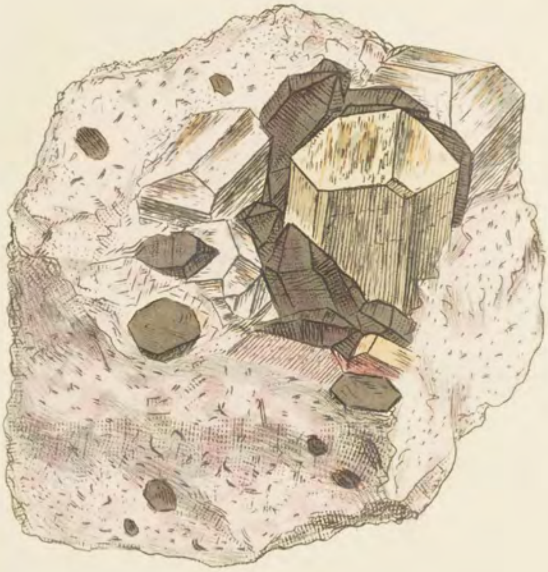
figure of it at the bottom of the plate on the left hand, showing the form of the fractured rhomb, and the lower side of a prism with a triangular face, formed of a bevilling from the edge of the sharpest angle of the side of the truncated end, as in the little middle crystal, which also shows the parallel fractures or flaws. *The right hand modification* is rather more common; viz. a six-sided column with two terminal faces, one primitive, or parallel to the fracture of the crystal, as in those before spoken of; and two directly opposite, forming at each end of the prism one primitive face and one opposite truncation, alternating with those at the opposite end.

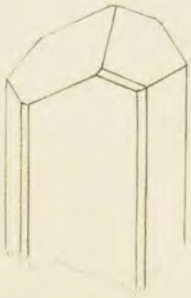
These are of the usual colour, viz. a lightish red*. They are almost too hard to be scraped with a knife, but Feldspar varies much in hardness; the crystals in the Moor Stone on Westminster bridge stand above the rest of the stone, are consequently of a harder nature, and do not wear so fast. In other instances it is found decomposing, soft, and nearly powdery†.

The primitive faces, or sides as it were, of those figured at the apex and base of the crystals, fracture smoothly and with facility. The other four break irregularly or roughish. The former generally show some sparkling illinitions, which are very apparent in some specimens, and serve to distinguish which of the terminal faces is the primitive one.

* White or transparent Feldspar, being found at Adula, is called Adularia Moon Stone, Feldspath nacré.—*Haüy*, &c.

† This is often called Kaolin, and is frequently found in China manufactories.





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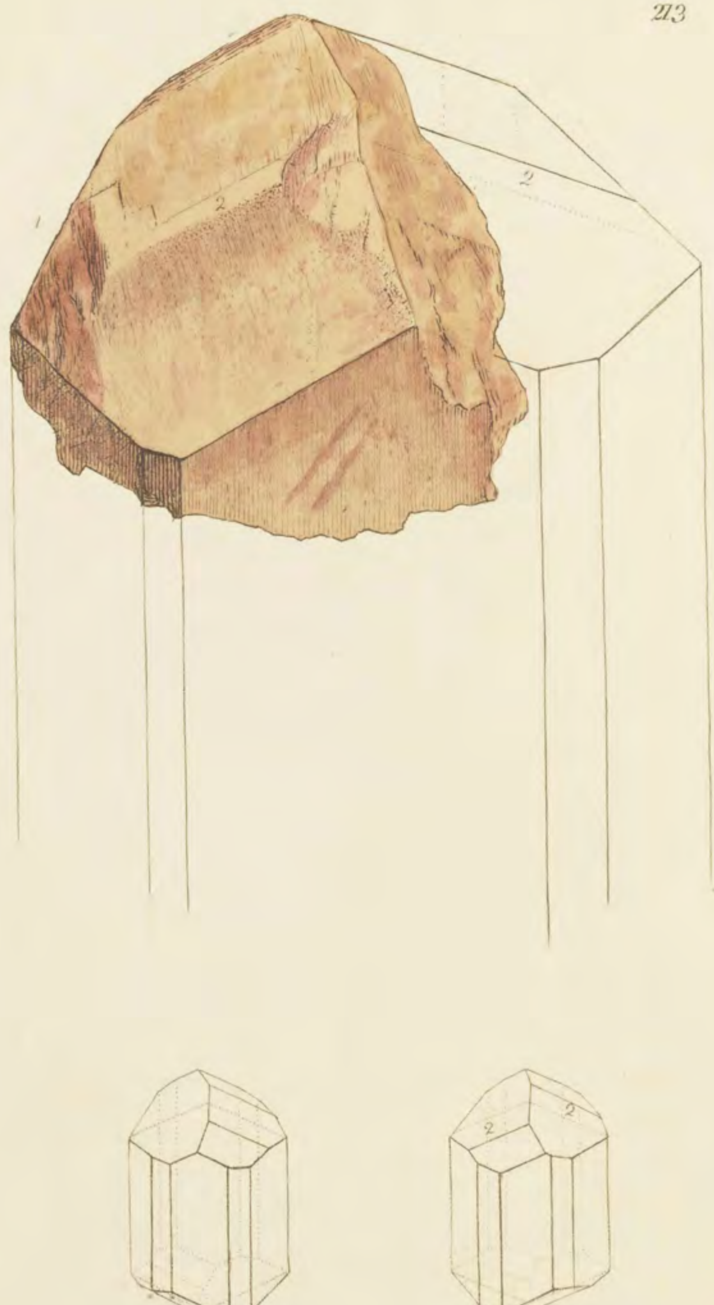

May 1.1807, Publish'd by Ja.s Sowerby, London.

TAB. CCXII.

THIS pretty specimen was sent from the same place as the last, and is of rather an unusual colour and appearance; having additional bevillings and truncations; viz. two on each of the more obtuse edges of the prism, forming four additional faces, and making in all ten faces to the prism and two small faces on the apex.

Feldspar differs in specific gravity from 2·272 to 2·7045. Under the blowpipe it melts into a whitish glass without addition. It also varies in analysis, containing

Silex from . .	43	to	70
Alumine . . .	14	—	37

Lime, sometimes Oxide of Iron, and also Potash; Barytes and Magnesia, according to Mr. Kirwan.

TAB. CCXIII.

PERHAPS one of the most curious circumstances which happens in this substance, is that of its crystals macling, which in this specimen they most truly do, according to the literal sense of that word, as distinguished from the hemitrope*. The present specimen is of a peculiar kind,

* A crystal one half of which is turned upon the other.—*Haüy.*

from the neighbourhood of Aberdeen, and may assist in explaining those of the same nature when they occur. It is part of a large crystal, which includes some Quartz and a few sparks of Mica, appearing at first a rude mis-shapen portion, to which I have added the outline for explanation.

The crystal is formed of two similar halves of different crystals, locked as it were into each other;—see *the zigzag line No.* 1.

The lower left hand figure represents a single crystal, in which the same faces are seen as are mentioned in *tab.* 212; the largest terminal face being the primitive one; but the small faces are greatly increased in size. If this crystal were divided in the middle in the direction of the dotted line, and one half turned round, it would not be in the least changed in form, answering nearly to Haüy's remark, 3. 602.

The right hand figure is formed of two halves taken from the similar sides of two different crystals (or, which is exactly the same thing, of two pieces cast in the same mould), each exactly corresponding with one half of *the left hand figure.* In this the primitive face is divided into two parts, and each part is brought to correspond with part of a secondary face, *fig.* 2, but may be easily distinguished by the fracture.

May 1.1807. Publish'd by Ja.s Sowerby, London.

TAB. CCXIV.

Dr. Buchanan, whose researches in the East Indies are well known, brought me some of the Breccia Rock, from Callender in Scotland, in which I found pebbles of Feld-spath. As Feldspar of this description has not, to my knowledge, been before noticed, I am pleased to have an opportunity of showing it here, where I have added some other amorphous Feldspar, known by the name of Petuntse in Scotland, found in various parts of the Pentland Hills, south-west of Edinburgh. This is of some esteem in manufactories of porcelain, being a fusible composition of Silex and Alumine, but varying in the proportion or quality. It often disappoints the workmen that gather it, as well as the manufacturers, and Quartz nearly pure has been sent to them as Petuntse, especially for the white or gray sort, which has least Iron, and would consequently be of most value for their purposes.

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May 1.1807. Publish'd by Jas. Sowerby London.

TAB. CCXV.

SILEX Quartzum.

Flints.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 1. Quartz.
Div. 2. Imitative.

MR. WARBURTON was so good as to bring me a specimen of this curious flint coralloid found at the bottom of the chalk-cliff on the eastern side, at Rottingdean in Sussex, where it is said to be very abundant. It is almost always the nature of flint to be formed into some shape expressive of its having been in a state of solution. This is every where evinced by the various substances it has taken possession of, but the distance of time since this happened cannot be positively ascertained; for although it is in a sort of stalactitic form, running like a gelatinous substance, yet it is always in a hard state, and looks as if it were almost recent, although it may have been for many ages in the same state. I have a piece of Coral from the neighbourhood of Bristol, by favour of Thomas Meade, Esq., which has Flint and some Calcedony passing into its interstices.

We figure these things that a subject of such universal inquiry may no longer remain in obscurity. Animal remains, especially the more earthy, such as corals, have left such various impressions * that it requires many specimens and much experience to recognise them.

The figure No. 1. is from Sussex. *No.* 2. was sent me with some others by my kind friend Colonel Walford. *No.* 3. I found with others of the same sort at the Isle of Dogs. *No.* 4. shows the inside of the same, and *No.* 5. was picked up in a gravel pit at Kennington.

* Some have considered these as parts of Mushrooms, such as Morels, &c. petrified, and I have one that has been compared to a marrow and bone, which it much resembles in form, sent me by the Rev. Dr. Sutton of Norwich. I have another which I found near Dulwich, which might very well be taken for a petrified *Agaricus*, showing, as it were, the impressions of the edges of the *lamellæ*, three or four inches in diameter and eight or nine in circumference.

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May 1.1807 Publish'd by Jas Sowerby London.

TAB. CCXVI.

CUPRUM nativum.

Native Copper, Leaf-like.

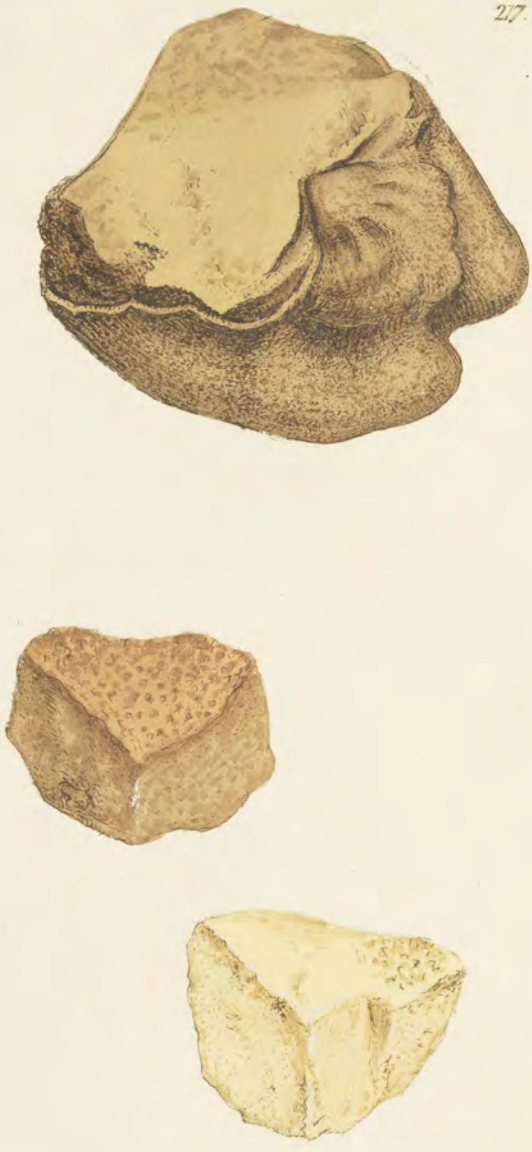
Class 3. Metals. *Order* 1. Homogeneous.
Gen. 10. Cuprum. *Spec.* 1. Nativum.
Div. 2. Imitative.

THIS curious specimen of Copper nearly in a pure state, and commonly called Native Copper, comes from Huelvor near Redruth in Cornwall. It is an excellent example of the manner in which the Copper was held in solution, and the solvent subsiding from it, leaving it in a state to explain the nature of the particles cohering, while supported by a sort of reciprocal gravity in the solvent, which allowed it to expand almost in distinct nuclei, by masses in the form of leaves, resembling vegetation, teaching us a beautiful lesson to explain the changes and formation of mineral substances*. I do not know that the rhomb, perhaps primitive rhomb, of Copper has been before noticed; it seems in this instance to form into the octaëdron;—see *the left*

* Mineral substances approach vegetation more perhaps than has generally been suspected, and may throw a light on that subject which has hitherto been a desideratum, or very obscurely understood. The present specimen resembles the *Fucus Hypoglossum*, or *ruscifolius*, in the leaflets coming from the middle of the larger foliage.

hand figure. The other figure exhibits the two sides of the plates chiefly formed of rhombs, showing as it were the under view. We could not measure these with any certainty, as they are very much interrupted and irregular. We, however, think it very interesting. The octaëdron, —see *the left hand figure*—and the rhombs in its direction seem to agree with the Native Coppers, and partly modify hexangular plates as they partly do in these specimens, and into consequently into double hexaëdral pyramids ;—see. *Vol.* 1 *tab.* 25.

I have the pleasure to say that I possess a small sample of this very curious Copper Ore, by the favour of my kind friend Philip Rashleigh, Esq., marked by him from Treskerby, Cornwall.



Apr. 1. 1807. Publish'd by Ja.s Sowerby, London.

TAB. CCXVII.

CALX carbonata, magnesiata.

Magnesian Limestone.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 3. Calx. *Spec.* 5. Carbonata.

Var. Magnesiata.
Div. 1. Crystallized.

SYN. Magnesian Limestone. *Tennant in Phil. Trans.* 1799, *part* 2.

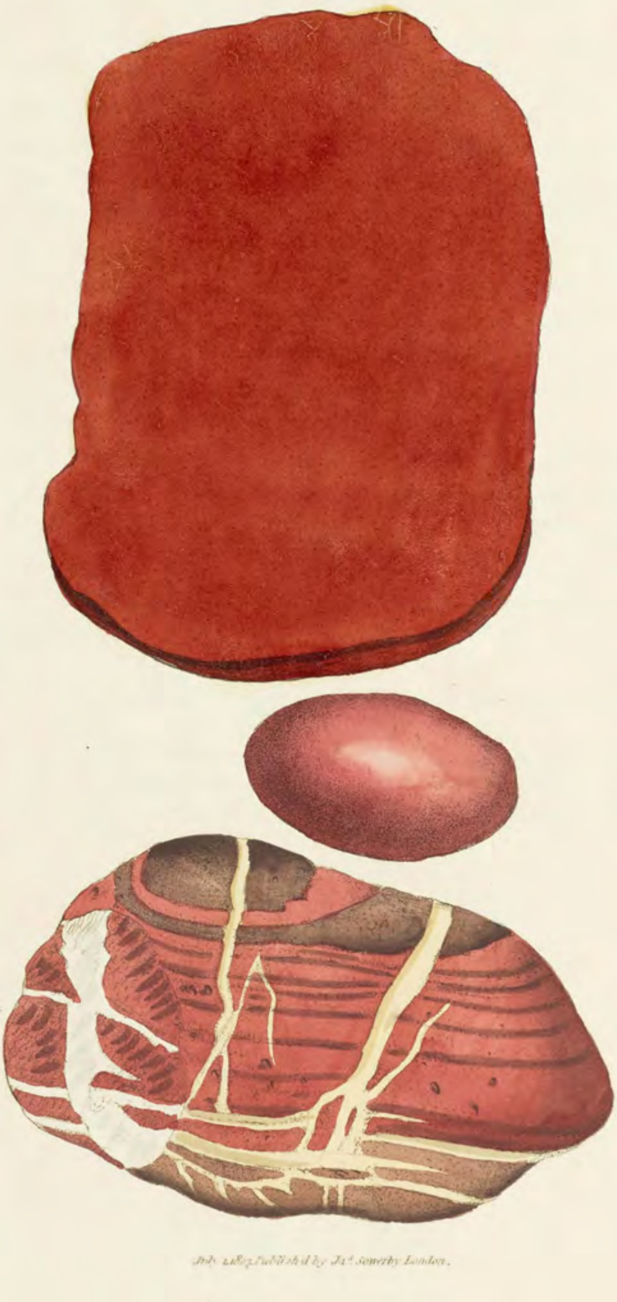
MR. TENNANT having favoured me with specimens of the stones spoken of in the Philosophical Transactions for 1799, I feel a pleasure in presenting so useful a subject to the public under such authentic circumstances.

The upper figure is what may be called the petrified remains of a shell, and is of a remarkable construction, especially on the hinge end. It has something of the appearance of an *Arca*, but is very different, however, from any that I have before seen, either petrified or recent. It was a curious circumstance that caused Mr. Tennant's investigation of the nature of these Limestones; for he observed in Mr. Marshall's Account of the Agriculture of the Midland Counties, that the Limestone found at Breden, near Derby, is destructive to vegetation. His experiments confirmed this account; and he found it to depend on the Magnesia, of which it seems that this Limestone contains about a fourth part. He further remarks, on the authority of Dr. Fenwick of Newcastle, that the farmers in that

country divide the Limestones into hot and mild. The former, he says, is no doubt magnesian, as it has similar effects on the soil, and is not so easily dissolved in nitric acid as the latter *. A little better acquaintance with these substances may make them known without analysis; and I have little doubt but that the farmers and their men, in the neighbourhood of the hot and mild Limestone, have some more or less intelligent way of distinguishing the one from the other, so as not to mistake—as lapidaries can tell white Agates from white Carnelians, although they confess they cannot tell how. The present specimens have a granular appearance, and, upon careful examination, are found to contain, or are indeed almost wholly formed of, little crystals agreeing more or less with the more perfect Pearl-spar—see *tab.* 19—and show the rhomboidal sides sometimes tolerably distinct †. The shell at the top of the plate, and the brownish piece in the middle, from Breden, as also the whiter piece below, have in these particulars the same structure.

* One of the properties of Magnesian Limestone is its slow solution in Nitric Acid.

† Thus Mr. Tennant has discovered Pearl-spar to contain Magnesia; which in part corrects Bergman's analysis of that substance, whence so many mistakes have arisen. Heavy Limestone or Dolomite of Tirie he finds to contain Magnesia in a larger proportion than above.



July 1.1807 Published by Jas. Sowerby London.

TAB. CCXVIII.

SILEX Quartzum; *var.* Jaspis.
Red Jasper.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 1. Quartzum.
Div. 3. Amorphous.

SYN. Quartz Jaspe rouge. *Haüy,* 2. 436.
Gemeiner Jaspis. *Emmerl.* 1. 243.
Jasper. *Kirwan,* 1. 309.
Silex Jaspis. *Linn. Syst. Nat. ed.* 13.

GREEN JASPER, or Ribband Jasper, has been figured at *tab.* 157, of this work. Red Jasper is also found striped, veined, &c. The present specimens are, however, the most usual of the red kind in Great Britain. *The upper one* came from a gravel-pit*, commonly so called, which has a large and curious variety of stones in it, from whence most of the old pavement of the city of York is composed. I am obliged to my kind and indefatigable friend the Rev. J. Dalton for this, and some other very curious specimens from thence, cut and polished; and it is not a little curious to know that the lapidaries of York have been a long time employed cutting these stones, which they call Marbles †, some of which are, however, as hard as Oriental

* Gravel-pits near London hold only common Quartz and Flint Pebbles of different sizes—see *p.* 88.

† Any largish stones, not Gems, are commonly called Marbles. I think, however, that this name should be confined to such stones as masons can polish without Emery, as the Marble of Italy.

stones. The present, like most British specimens, are more porous than the Oriental ones, but in other respects are the same, viz. Quartz mixed with Oxide of Iron and Argill. It is very handsome, and takes a good polish. Stones of the same sorts are found on many of our coasts, but are still more porous, and veined with opaque Quartz, &c. *The lower specimen* is from Devonshire, sent by my friend G. Montague, Esq. I suspect they fall from near the Serpentine Rocks, and that the red Serpentine may be traced from the softer state to the indurated or harder Serpentine holding Jasper, and may thus have been occasionally confounded with it. Serpentine may generally be scraped with a knife; Jasper, I should think, never: and it is perhaps worthy of observation, that different states of red Serpentine resemble Brick; and some curious persons have picked up these in various states from that resembling soft Brick to Jasper, considering them as Brick passing from the more soft beginning of petrifaction to the more hard and stony.

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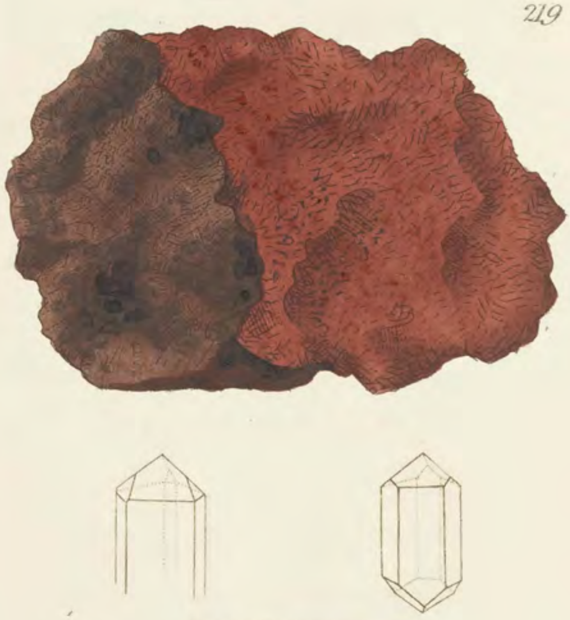

July 1.1807. Publish'd by Jas. Sowerby London.

TAB. CCXIX.

SILEX Quartzum; *var.* Jaspis.

Jasper.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 1. Quartzum.
Div. 1. Crystallized.

SYN. Iron Flint. *Jameson, v.* 1. *p.* 134.
Eizen Keisel. *Werner.*

THIS has an appearance so peculiar, that it may be readily distinguished when once seen, although on careful examination it will be found to differ very little, if at all, from the other coloured Jaspers, either in its nature or component parts. It is said to be crystallized, like Quartz, with the pyramids terminating in three faces, and sometimes with the other three belonging to Quartz very small *. The fact is, that this substance is no other than Quartz with a red or yellow Oxide of Iron, and is often partially crystallized, though sometimes otherwise with an appearance rather peculiar, which occasionally resembles a coarse red sealing-wax, or the cement used by lapidaries, made of pitch, resin, and brick-dust. Its hardness is the same as that of Quartz. Its peculiarity at first sight has been suf-

* We have independent crystals of Quartz from Matlock, &c. of the same form.

ficient to make those who have found it, and who were pretty well versed in the science of Mineralogy, inquire what it was; and Werner, I suppose, seems satisfied that it ought to have a name which might distinguish it.

The specimen figured comes from Bristol, and I have some also from near Keswick, in Cumberland. I believe it is not very rare. *The lower geometrical figures* are intended to show the forms of the crystals as above mentioned.

[illegible] published by Jas. Sowerby London

TAB. CCXX.

SILEX Quartzum.

Variegated Flint Pebbles.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 1. Quartzum.
Div. 3. Amorphous.

SOME time since Mousehold Heath, near Norwich, afforded much entertainment from the varieties of stones found near Kett's Castle, such as Petrifactions of Echini, Geodes, and variously marked Flint Pebbles nearly resembling the Egyptian Pebbles, or Jasper, as it is called by Kirwan, &c., it bearing much the same affinity to that, as the British do to the foreign Jaspers, being more porous and ordinary as to hardness, &c. It, however, may often serve as amusement to a fertile mind in furnishing it with whimsical shapes; and it is astonishing to see what a difference there is in the fanciful ideas of the many curious forms observable in these stones, at different times. However, it may happen that the lines give so general an appearance of a face, even a likeness of a known character, that they have met with an almost universal approbation and agreement, and are valued accordingly. The present specimens are rather curious examples of the first mentioned, and rather undetermined in my mind, yet may be more clear to others. Thus *the left hand upper figure* is like a monster, something like a boar, which, when turned the other side upwards, resembles a Rabbi's head. *The right hand upper figure* is something like a tiger. *Those at the bottom* nearly speak for themselves. *The oval one* is a boy; *the other,* like a distresed mariner reposing or leaning on a rock.

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July 1.1807. Publish'd by Ja^s. Sowerby London

TAB. CCXXI.

SILEX steatites; *var.* induratum.
Red and Green Serpentine.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 13. Steatites.
Div. 3. Amorphous.

I do not much admire the name Serpentine, nor do I think it very appropriate to this substance, and it has indeed been the cause of much confusion, as different states of Jade, Asbestos, and Actynolite have been mistaken for it. I should rather consider this substance (which has generally been called Serpentine) as a variety of Steatite more or less veined with the help of Oxide of Iron, often red, and of the colour of brown Bricks, as in some parts near the Lizard Point, and Kynance Cove, where the rocks are massive, and of a dark green on the outside, but when broken look within of a brick-red, and the varieties found about the Lizard Point are veined with red and different greens. *The upper specimen* was obtained from thence by favour of my kind friend P. Rashleigh, Esq. and is chiefly green veined with red and a bright silky red interspersed, which is reckoned rather rare. There are also bright plates of a substance about it which is considered by some as a sort of crystallization of the Serpentine, and is called by the general name of Schillerspar. *The lower specimen* is such as is found at the Lizard, Portsoy, or in Wales, and is in part approaching Jade*, but is much softer. This and its varieties often include the silky Asbestos;—see *tab.* 123.

* Jade is hard and tough, or it would not answer the purpose of Hatchets to the New Zealanders.

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July 1.1807 Published by Jas. Sowerby London

TAB. CCXXII.

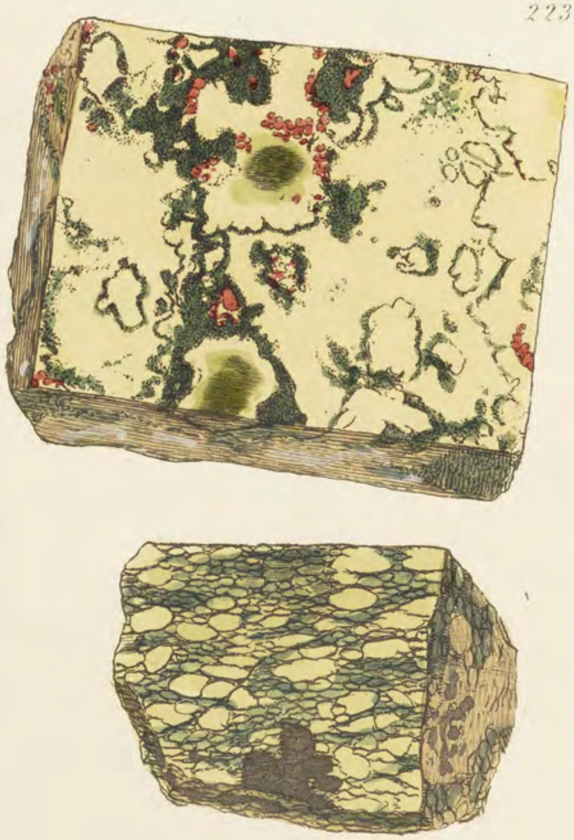
SILEX steatites.

Soapstone, or Soaprock Steatite.

STEATITE, commonly called Soaprock, is found in Norway and China, as also at Portsoy in Scotland, and at the Lizard Point in Cornwall. It is found of a fine waxy white like white hard soap or Windsor soap, and feels so similar to the touch as naturally to assume that name. It is occasionally coloured yellow, often so as to resemble common yellow bee's wax; it is also occasionally dendritically coloured with Iron Ochre or Manganese, from light yellow, light gray, &c. to red or crimson, as figured. The whitest is of course preferred in Porcelain, for which it is often used. It is found of various degrees of hardness, from such as is easily scraped by the finger nail to such as can scarcely be scratched by a pin. It, however, hardens in the fire, according to the time of exposure, until it will scratch glass like Quartz; the more transparent becomes opaque, and if polished before putting into the fire will retain the polish after heating. The coloured varieties are affected by heat according to what the colouring matter may be. I suspect that this may be the Hoa-che of the Chinese, which has superseded the Kaolin; but so far as I have seen they do not understand it so well, although the china made from it is said to be better in some respects. I believe it is better

understood in England. It may be chosen so as to be cut easily into any form, and the Chinese use some varieties for carving figures and very delicate fret-work. The softest might serve this purpose as well as the hardest sorts, and either might be hardened afterwards by heat.

The upper kind comes from the Lizard Point in Cornwall, and is found in veins in the Serpentine Rock. *The lower piece* is extraordinary for the strata of colours, which perhaps are as vivid, and distinct, as will ever be found in this substance. I have another specimen, by favour of my friend the Rev. H. Davies, with Magnetic Iron in it in a small quantity.



[illegible] Publish'd by Jas. Sowerby London

TAB. CCXXIII.

SILEX steatites; *var.* indurata.
Indurated Steatite.

Perhaps this substance may have so much resembled Porcelain, that when polished it might be mistaken for natural Porcelain, and it may possibly be very nearly the same in regard to the component parts, especially with that which is made of Petuntse and Kaolin. The present specimen from Portsoy must be allowed to be softer than the Porcelain, but would nevertheless become harder by being heated. It is chiefly composed of Silex, Alumine, and Magnesia, like the last substance, but in a harder state, and the tints may give a lesson for a new way of preparing colours, if that were necessary, and may indeed be useful, though the colouring of Porcelain is now tolerably perfect. The colours in this seem chiefly to depend on Oxide of Iron in different states; thus the yellowish hue is owing to a mixture of a pale yellow Oxide in a small quantity, and the red to a mixture of very deep Oxide of Iron; but the green may arise from a mixture, as it were, of Chlorite. This is sometimes intimately mixed with Steatite, and is curiously dispersed about the present specimen in lines, spots, &c. Indeed these and the larger yellower spots are nearly the same in appearance with the Hatchet Stone of the Leeward Islands, called Nephrite, Jade, &c.; but

known by its greater softness as Serpentine. This, therefore, includes a very interesting lesson, and I am obliged to Earl Seaforth for so handsome a specimen.

The lower specimen came from North Wales, and was sent me by the Rev. H. Davies: the Chlorite which holds some Pyrites in the veins or marbling of this, and the Pyrites with the rest of the substance, are not far from agreeing with the Meteor-stones.

Steatite and Serpentine differ but little except in the colour, which seems much to depend upon Iron. Steatite has been found in secondary crystals, chiefly in the form of those of Quartz.

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July 1 1807 Publish'd by Jas. Sowerby London

TAB. CCXXIV.

SILEX Petuntse.

Kaolin.

THIS substance (found at St. Stephen's in Cornwall, &c.) has long obtained the name of Kaolin because of its resemblance to the Earth so called in China, on account of its being used in Porcelain manufactories, and is by some considered as necessary to be used with the Petuntse for hardening the mixture for the better sort of Porcelain. It is a kind of decomposed Granite, being an aggregate of Feldspar, Quartz, and Talc, and is, for some purposes, ground up together to make Crucibles, but it depends upon the proportion of the three ingredients to determine how it may best be used. If carefully separated and washed, the decomposing Feldspar, with what Talc and perhaps fine Quartz are among the washing, make the Porcelain Clay, (Feldspath argiliforme of Haüy,) commonly so called, and the difference observed by Wedgewood, viz. of 60 parts of Clay and 10 of Quartz, depends upon circumstances that seldom allow any aggregate rock to be very regular.

Authors differ in the analysis thus:

Silica from . . .	52	to	71
Alumine	15	to	41

with occasionally a little Lime, Magnesia, Sulfate of Barytes, and perhaps Iron, which may sometimes give a redness more or less common in Feldspar.

One of its characters is, to be infusible: this, however, may depend upon the proportion of the mixture. Some say it is infusible in a porcelain-heat; others say, nearly infusible in the greatest heat of a porcelain furnace. According to Achard, Kirwan, *v.* 1. *p.* 58, determines that

Argil and Silex are infusible in all proportions. Kirwan, *v.* 1. *p.* 66, says, three parts of Argil and three parts of Silex with one of Magnesia form a Porcelain. Other proportions of the same substances remained as a powder, hardened only or formed a Glass, porous Enamel, Porcelain, &c. This shows the necessity of having a knowledge of the nice distinctions sometimes necessary in comprehending nature. It was with a Clay of this kind that Wedgewood formed his pyrometers; but it is said that after the mixture was exhausted he could not venture to make any more, as he could not find Clay that he could depend upon as having the same proportion of parts, and consequently could not produce any precisely of the same standard.

Earths of this kind are found wherever Granite rocks occur in a decomposing state in greater or less abundance, differing in the size or quantity of the different ingredients, the Quartz in large or small grains, with more or less Talc, which holds Magnesia, and perhaps helps the decomposition when in contact with the air, which last seems necessary, as Granite is never considered as Kaolin till thus decomposed, although perhaps containing the same substances. It is curious to remark that these substances, afforded by nature to suit our particular purposes, are generally known by some external characters which distinguish them in a general way, and those used to it do not care to venture on any other. In this instance the substances may vary much, as is seen by the analysis; and perhaps the less decaying rock might, by affording a more suitable proportion of parts, sometimes answer the purpose better. The decaying rock is, however, more easily gathered. This may be convenient to be known to those whose estates are contiguous to the other necessaries for porcelain manufactories.

The specimen figured shows irregular spots or grains of Quartz, with some shining greenish particles of Talc; the remainder is chiefly Earthy Feldspar or Petuntse.

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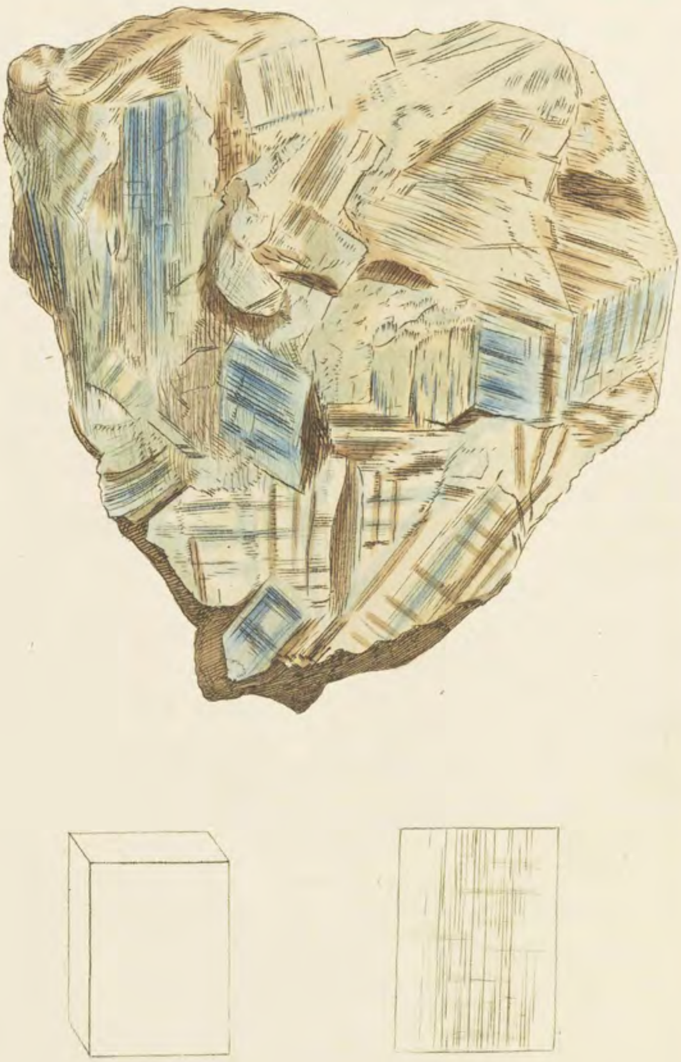

Sept. 1, 1807. Publish'd by Jas. Sowerby London.

TAB. CCXXV.

ARGILLA cyanea.

Cyanite.

Div. 1. Crystallized.

Syn. Sappare. *Saussure, Journal de Physique, Mars* 1789. 213. *Kirw.* 1. 209.
Cyanit. *Emmerl.* 1. 412.
Disthène. *Haüy*, 3. 220.

This beautiful and curious substance is said generally to occur in primitive mountains abroad, and in Scotland. The present specimen, from near the Grampian Hills, Kincardineshire, is nearly of the best or deepest colour: few are deeper; and specimens are occasionally almost colourless. We do not approve the name of *Kianite* or *Cyanite*, taken from its colour, as it does not serve to distinguish this species from other blue minerals. The name *Sappare* also confounds it with Sapphire; and again, *Cyanite* is very similarly sounded, by some, to *Sienite*, which is an aggregate. We have placed this stone in the genus *Argilla*, to which analysis plainly shows that it belongs; and we have also made use of *Cyanite* as its trivial name, for it is scarcely known by any other. We have quoted a part of Haüy's description, as most applicable to the substance. The crystals may be divided by two cuts inclined upon one another, at an angle of about 103°, one of which is much neater than the other. *Spec. Grav.* 3·517. A very sharp,

pointed piece will scratch glass, and may be scratched by a steel point upon the large faces of its laminæ; but not upon the lateral ones. The refraction is simple. The primitive form is an oblique quadrangular prism, of which one plane is inclined upon the other, at an angle of about 103°.—Integrant molecules the same. Infusible without addition. Seldom shows any determined crystal, at least among English specimens.

Analyses	by Saussure,	by Lauguier.
Alumina	55	55·5
Silica	30	38·8
Lime	2	0·5
Magnesia	2	
Oxide of Iron	6	2·75
Water		0·75

July 1. 1807. Publish'd by Ja^s. Sowerby London.

TAB. CCXXVI.

SILEX magnesiatus.

Common Asbestus.

Div. 2. Imitative.
Var. Fibrous.

THIS substance has been long known in the Isle of Skye. I believe it has not been discovered in Ireland, but may perhaps be found in North Wales. The length of the fibres in the present specimen gives it a remarkable appearance, and the leek-green varieties but faintly convey the idea of a stone, particularly in a figure. It is scarcely flexible, except in very small fragments, although it has that appearance, especially *the middle twisted piece.* It is finely fibrous in its divisions in some parts, in others rather solid and plated. Fragments splintery, breaking with hanging fibres. Lustre rather internal, partly pearly. To the touch it is smooth and softish, scarcely greasy; is readily scraped with a knife, and is somewhat transparent at the edges. *The lighter left hand specimen* is more solid, and mixed with the amianthine rock, in a curious semi-detached manner; breaking at right angles. The varieties between these may include most known, as there are but small differences. It sometimes approaches *Lapis nephriticus,* which is more solid, tough, and hard.—*Spec. Grav. from* 2·547 *to* 2·995.

July 1.1807, Publish'd by Jas. Sowerby London.

TAB. CCXXVII.

Dark green wood-like Asbestus.

Div. 2. Imitative.

Commmon Asbestus sometimes resembles rock-wood—see *page* 124—and is often very different in appearance, at first sight, from the preceding figure.—It is therefore sometimes gathered in masses to be cut and polished by the Lapidaries, when the light refracted through the flat face, from the fibres, gives it something of a chatoyant, satiny, or pearly lustre, which is much admired, especially when some of the fibres, curving into concavities, are relieved by those in a contrary direction, or by the dark ends. This specimen has some Talc, Pyrites, and Magnetic Iron in *the lower dark part,* which give it a curious appearance, especially where the Talc is prominent.

Aug 1, 1807. Publish'd by Ja.s Sowerby, London.

TAB. CCXXVIII.

SILEX fragilis.

Actynolite.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* Fragilis.
Div. 2. Imitative fibrous.

SYN. Strahlstein. *Emmerl.* 1. 418.
Actynolite. *Kirwan*, 1. 167, 178.
Actynote. *Haüy*, 3. 73.

MR. KIRWAN seems to have given an excellent description of this substance, perhaps the best extant. I shall, therefore, make use of the following applicable part of it: "Fragments long, splintery, and exceedingly sharp, so as to be difficultly handled without injury. Hardness difficult to estimate, on account of its brittleness." He also says, "We may vindicate to this species the stone called by Saussure *Schorle en fillets brillants et fragiles;* so sharp as scarcely to be handled with impunity." In these characters it is certainly peculiarly different from any other species of Mineral, and its particles are so fine and sharp as to put me in mind of the setaceous spiculæ or hairs on the pod of the *Dolichos pruriens.* We might even suppose it as good an anthelmintic or vermifuge, by its mechanical action; but its hardness would undoubtedly make it too violent.—It very readily penetrates the skin, and the consequent irritation is more violent than the most troublesome itching,

as it gives an aching pain. I have, by favour of the Rev. H. Davies, and the late ingenious Mr. W. Day, received specimens of this Actynolite said to come from the Isle of Skye, where it appears to be abundant, and in great variety. —*Spec. Grav. from* 2·950 *to* 3·903.

Saussure found in his specimen,

Silex	0·5525
Argill	0·3018
Magnesia . . .	0·1087
Lime	0·0484
Iron	0·0148

It is often largely or finely and variously striated and undulated; it also varies much in colour.—*Tab.* 229 is a large undulating dark-green variety. I have received beautiful dark shining green Actynolite, mixed with Copper Ore, from Maudlin mine in Cornwall, by favour of Philip Rashleigh, Esq., Dr. Turton, and J. G. Children, Esq.

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Aug 1, 1807, Publish'd by Jas. Sowerby, London.

Aug 1.1807 Publish'd by Ja^s Sowerby London.

TAB. CCXXX.

Stellated Actynolite.

Div. 2. Imitative.

THIS is a beautiful variety of Actynolite; its fibres are somewhat crystallized in flat prisms, diverging more or less from different centres, bundled and spreading.—When separated, the prisms are nearly transparent, 8-sided (six sides are generally described), two of which are commonly attached or adhering to the others; they are of different dimensions, with a coarse roughish appearance, perhaps from the fibres so continually crossing each other at different angles, and disturbing the transparency of the crystals, and their satiny appearance, which sometimes beautifully reflects the light in broadish masses. The piece represented is a fragment of a specimen which seemed to have been part of a large flattish bed or vein, from the Isle of Skye. I have some varieties mixed with Sulphuret of Copper, and some, nearly black, resembling Schorle, with which it is often confounded, as it is also with Hornblende; but all its varieties are much more brittle than either of these.

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Aug. 1. 1807. Publish'd by Jas. Sowerby London.

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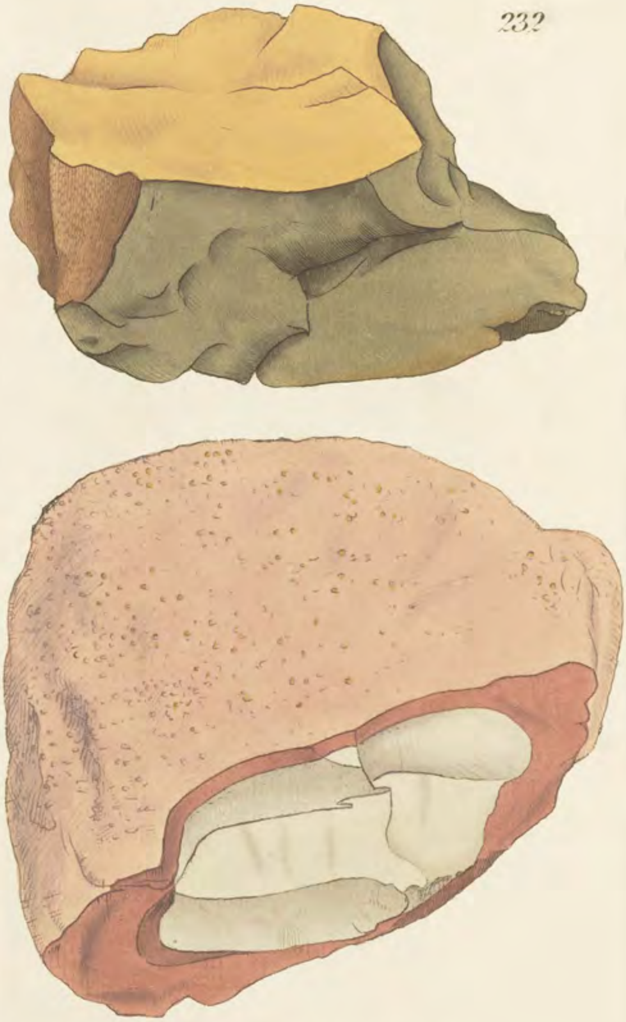

Aug. 1. 1807. Publish'd by Jas. Sowerby London.

TAB. CCXXXI and CCXXXII.

QUARTZUM talcosum.
Fuller's Earth.

Class 2. Earths. *Order* 2. Mixed.
Gen. 4. Quartzum. *Spec.* Talcosum.

SYN. Fuller's Earth. *Kirwan. Babington,* 52.
Walker Erde. *Emmerl.* 1. 375.
La Terre à Foulon. *Brochant,* 1. 464.
Terra fullonica. *Linn.*

THIS valuable Earth is rather peculiar to Great Britain; it is, however, said to be found in Saxony, Alsace, and Sweden. Hampshire and Bedfordshire are the only two places mentioned in England by most authors. Dr. Thomson says, "It occurs in greatest perfection in the South of England." I, however, cannot find out that any has been discovered in Hampshire; and indeed the analysis usually quoted from Bergman does not appear to me to indicate Fuller's Earth*. His Grace the Duke of Bedford was so good as to supply me with an excellent specimen from Aspley; and I have seen the pits in Surry and Kent. A sort is also found in Nottinghamshire. I exhibit a small

* It is remarkable, that of many acquaintances of whom I have inquired, there is not one who can find out any place in Hampshire where it is found, and I suspect something wrong in all that quote Bergman's Analysis.

piece from Aspley, as above: it is the lightest and softest in my possession, and has a character peculiar to the best for use, viz. a semi-transparency at the edges, even when dry, as I figure it. *The lower specimen* came from Nutfield in Surry, which is less transparent at the edges when dry, and is darker coloured, especially when in the pit, where it is called *blue*, in a manner synonymous with Blue Clay*. I have a Sandstone from the bottom of the Bedfordshire pit, which has dark-green particles of Chlorite, such as is found in Cambridgeshire, and in the Irish Mulatto-Stone. I am told that under a surface of about six feet there are several strata of whitish and reddish sand, under which is a stratum of Sandstone, then a sandy Fuller's Earth, called *Cledge*, which is thrown away; and that the proper Fuller's Earth is found at a depth of about 14 feet, when there is some redder Fuller's Earth, called *Crop;* the lower half of the stratum is called *Wall-Earth*, and is reddish: but I suspect this must vary according to time and circumstances.

The Surry Fuller's Earth is found at different depths, as from nine to twenty or thirty feet. At one place, upon a hill, the surface was a wood; and when I examined the Earth at the bottom of the plants, I found it full of semi-transparent waxy particles with common light earth, and some ferrugineous appearances: below this were different strata of small stones, lying tile-wise, being flattish, and some approaching Hornstone, with a ferruginous sand, and green Chlorite particles: these are alternate, two or

* Dark blackish Clay, such as Tile-Clay, is commonly called *Blue Clay*.

three times, when larger and rounder stones succeed, which are often *Septaria,* holding shells and petrified wood: under these are small or large stones, flat and squarish, some of three or four feet in thickness, and often arranged in a very orderly manner, with squared joints, like a castle-wall; between them are flat stalagmitical flakes, composed of rather porous and light Carbonate of Lime, looking like mortar, to help the deception. Often next to these are a few small flattish stones and a ferruginous Fuller's Earth, which is sent to London for housewifery purposes. The Earth below this has a dark blueish slate colour for six or nine feet: this is brought out in lumps of from ten pounds to a hundred weight, carried to a shed to be weighed for sale, and in a few hours is placed in a waggon to send to be shipped near London Bridge for Yorkshire. It may be observed, that as it cracks in the pit by the access of the external air, the outsides of the lumps become more or less ochrey, as the second figure shows, and afterwards the whole bleaches, and we cannot blacken it again; for, if it be wetted, it becomes lighter still, and falls to pieces: this may depend on the Oxide of Iron, and something carbonaceous. As the *Spec. Grav.* of Fuller's Earth is about 2, it is a curious fact to understand that large masses of Sulphate of Barytes * are found suspended in it; but of this more will be said hereafter.

Kentish Fuller's Earth, *tab.* 232, *upper figure,* is found at present near Bersted, but not in abundance, like that of Nutfield, and is not above from three to six feet from the

* Whose *Spec. Grav.* is about 4·5.

surface, under mixed sand, and differs also from that in being found with much water, and not being in large pieces, or above half a pound, as well as in requiring careful picking and washing; when it is laid out to dry, and then shedded for carting to the Medway. It is rather softer to the touch than the kind from Surry, but generally dries darker, and has a more ochraceous crust. The three sorts of which I have spoken have all a very similar fracture, perfectly conchoidal, with a reverse inclining to the letter S.

Nottingham Fuller's Earth, *lower figure*, varies like the others, but is generally more opaque and soft, rather than waxy, in appearance. What has been sent me evinces the admirable contrivance of Nature. The former varieties were infiltrated through sand and between stones, whereas this is preserved, as it were, in large nodules of red clayey Sandstone, and is thus as effectually distinguished as the kernel of a nut. I understand these are found in sandy rocks, and that women and children strip the Fuller's Earth of its coloured covering.

This earth is met with in other places, but I believe not in sufficient quantities for market.

These specimens of this substance, from what I can judge of them without analysis, are of the best sort, and should seem to contain much Magnesia. Its waxy, soft, or unctuous appearance would indicate it to be a Steatite Clay, and its greenish hue certainly bespeaks the presence of Talc or Chlorite, which is so well incorporated with it as to seem to help its granular texture. In fine, it appears a more decomposed state of Steatite, like many of the neighbouring

stones; some having the whole composition, yet being in the form of a granular stone; viz. whitish Steatite, green granular Chlorite, Silex, and Clay. Some of the stones found above it are coated with this, and are Flint, or Flinty Hornstone, within.

Fuller's Earth is more or less massive, dull, somewhat granular. It does not soil the fingers, and may be polished by handling, though more by the finger nail; particles in grains, and on the edges, often admitting light, give it a waxy transparency. It feels soft and greasy, is easily scratched by the finger nail, cracks irregularly on drying; fracture large or small, conchoidal, deep, zigzag, sharp and angular, sometimes broad and plated; roughens by wetting, scarcely adheres to the tongue, becomes lighter on drying, but if pressed before it be dry, nearly retains its original colour; falls gently to powder in water, where it feels soft, and does not stick to the fingers.—Colour light-brown to dark-greenish brown, uniformly of one tint, or rather accidentally spotted, striped and clouded, sometimes with talcose particles glistening in it. For sale it is generally chosen as nearly uniform as possible.

As there appears to be some confusion among the authors I have looked at for this Earth, I have thought it the more necessary to be thus particular.

Mr. Hatchett once intended to examine the Fuller's Earth chemically, and made much inquiry about it, but we have to regret that he did not complete his experiments. He informs me that he knew of none from Hampshire, and that he believed Bergman and others had been led into a mistake.

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TAB. CCXXXIII.

CALX sulphata.

Sulphate of Lime, or Gypsum.

Class 2. Earths.	*Order* 1. Homogeneous.
Gen. 3. Lime.	*Spec.* 3. Sulphate of Lime.

GYPSUM, when crystallized on an amorphous gangue, is not very generally known, and has been very little noticed by authors; common Selenites only have been placed among the crystallized varieties*.

The present specimen is from Derbyshire, where largish blocks or lumps of amorphous Gypsum are found, often very white, looking like fine Carrara Marble, and sold for various purposes, as making what some call Alabaster figures, turned candlesticks, imitations of fruit, &c.† When the workmen are cutting it, they frequently find hollows including the crystals; but these do not often come into the hands of the curious. The white face of the hollow has often a snowy appearance, and is finely grained, upon which the pellucid crystals look sometimes very beautiful. The crystals are generally more clear and delicate than the Selenite, not having clay among them; and this is all the difference between them, since they are liable to the same forms of crystals, which are composed of opposite trape-

* Crystallized Selenites—see *tab.* 67, are said to want a little Carbonate of Lime to make plaister, but the other varieties have naturally a sufficiency.

† The less solid pieces serve, when burnt, for casting plaister figures, and for inferior purposes.

ziums, and are somewhat undulated, the same, with some variations, as *the figure beneath*, which comes from Oxfordshire, and is commonly called prismatic from its long columnar appearance; this is evidently mixed with clay, as *the lower figure* of *tab*. 67.

This sort of Gypsum is said to be found in masses of different sizes, but seldom larger than three or four feet in thickness; they are generally rugged, and broader than they are thick.

The antients are said sometimes to have used the transparent Gypsum in the place of glass in windows; whence it has been confounded with Mica and Talc—see *tab*. 180, 181, &c., which substances are still often confounded, although so distinct, as I presume this work now clearly explains.

The temple of Fortune at Seia was built of this stone, and without windows. The semi-transparency of the Gypsum admitted the light, and Pliny said that the temple appeared as if lighted from within*.

Some specimens of the crystallized kind have lately been found at Alstone Moor on blende, &c., and by some means got the title of Asbestos. They are sold in moderate pieces for a guinea each, or perhaps more, as the dealers may be more or less acquainted with the subject.

* Haüy 2. 290. In Warwickshire, I am told that Gypsum has been used for building the outside of houses; where it is burned with wood for that purpose, and the whole mixed up together, giving it a greyish cast. It is said to be extremely durable, and is carefully saved when a house is on any occasion pulled down, as it is still more durable even if it has lasted centuries in the first instance.

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TAB. CCXXXIV.

Spiculated Gypsum is also new in description, as far as I know; and from what has been said, such a thing could hardly be expected. It is, however, necessary that any mineral should be known, in whatever form or variety it may be; and Gypsum being at present so much recommended as a manure, makes it not less necessary, as otherwise Gypsum might be brought to manure Gypsum, or be refused by those who prepare it, as useless.

This is a pretty and delicate variety. The crystals are much confused, but seem to be a mass of trapeziums—see *tab.* 67—piled or formed into little spires; the points of the trapeziums being mostly inclining upwards. It came from Derbyshire. *The under specimen* might be considered as a red or rose-coloured Gypsum. They are often coloured with red Oxide of Iron, in various degrees. This specimen appears of rather an uncommon form; the crystals are something like the above, but lie horizontally; and it would seem as if the whole was a sort of Stalagmite, having fallen into this form in a particular state.

I received this specimen by favour of my kind friend Dr. P. Murray, from the limestone quarry at Bilton in Yorkshire, along with another very instructive one, part of a larger mass, with a vein of whiter striated Gypsum passing into it, holding almost orange-coloured, or deeper tinged, perhaps, primitive rhombs within it—see *the left hand figure* and *right hand geometrical one.* This varety is sometimes compact and hard enough to be turned and polished for ornaments.

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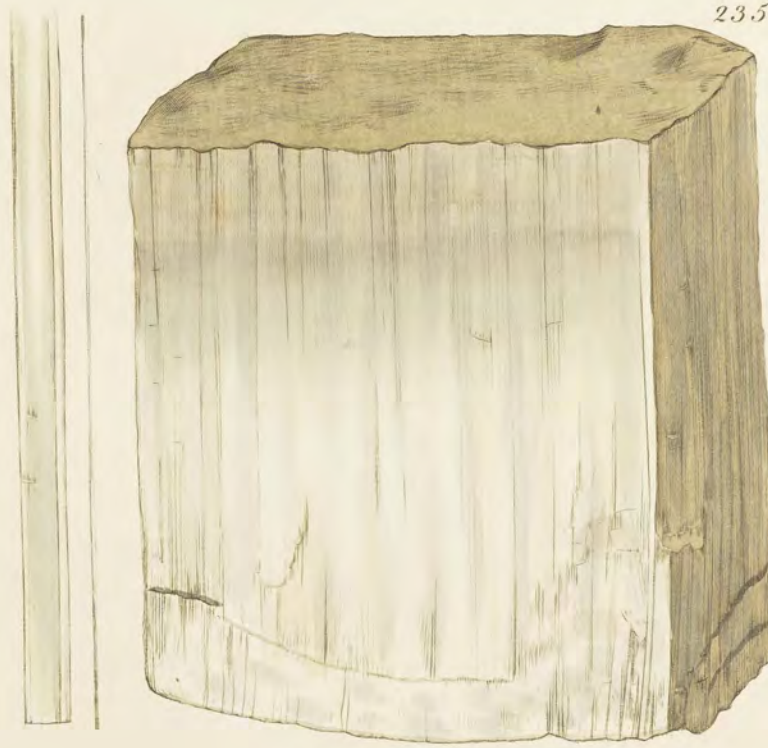

Oct. 1. 1807, Publish'd by Jas. Sowerby London.

TAB. CCXXXV.

Fibrous Gypsum.

THIS variety is occasionally found near the others in broad veins, if I may be allowed to call them so, looking like veins on the side of the cliff when exposed, but very broad, and varying in thickness and flatness. It is not fit for carving figures, as its structure will readily show; but for making plaister, for casting, stucco or manure, it is as good as the others, and much attracts the attention of the common observer by its regular and finely striated appearance. It is remarkable for the perfect straightness of its fibres, which are sometimes four or five inches or more in length, and always divisible even beyond our limits of calculation, being an excellent example of a common fibre. Lewenhoeck might have said of this as he said of the muscular fibre, and he would have been nearer the truth—see page 40 of the second volume of this work. This variety of Gypsum has something of the appearance of the Satiny Carbonate of Lime: it, however, is not, like that, sufficiently hard to take a polish, but a fresh fracture is equally bright, whereas that has not so bright a natural fracture, and requires polishing to add to its beauty *. The fibres are so

* I have truly stated where the satin-spar is found: Late authors have very erroneously quoted Derbyshire for it, where, indeed, it has been sold.

compact in some parts as to give this stone a particularly solid and glassy appearance, but in those parts they may nevertheless be easily separated, even by the finger nail.

As Gypsum dissolves sparingly in water, the specimens cannot be washed without great care, and brushing scratches them; even the common air spoils their appearance, which is worth preserving: they should therefore be kept very attentively.

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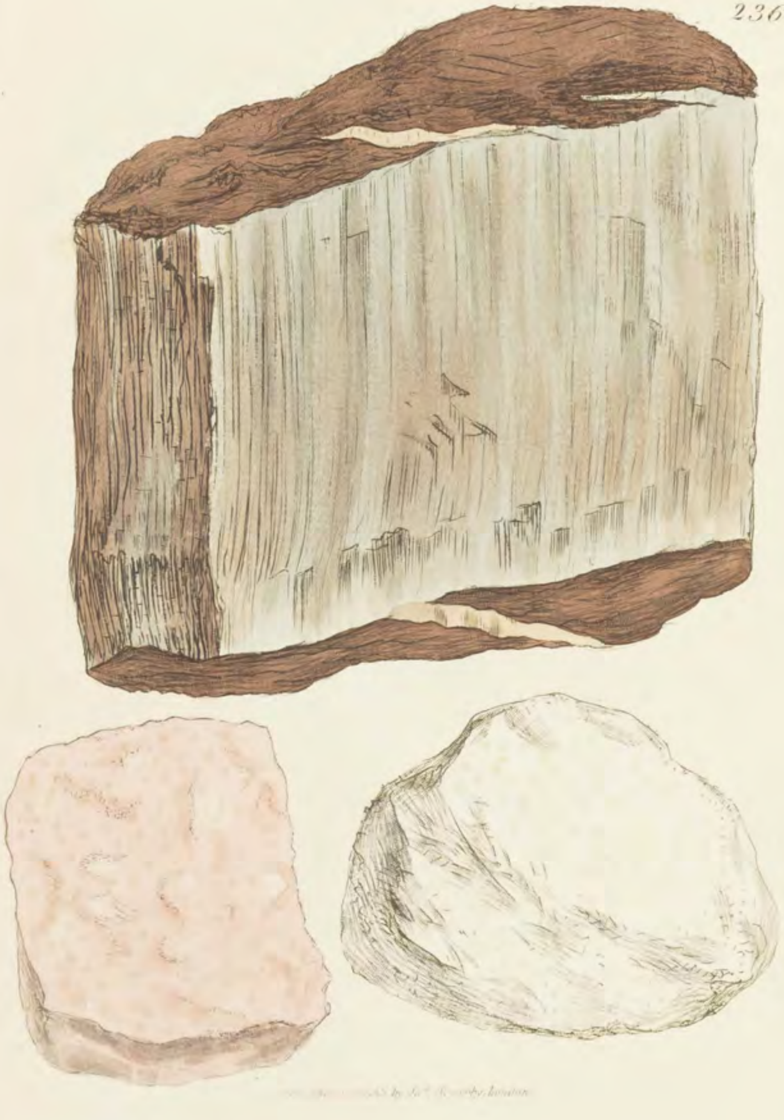

[illegible] by Jas. Sowerby, London

TAB. CCXXXVI.

When on the coast at Sidmouth, I had the gratification of seeing the red marly sides of the cliffs or rocks beautifully, to appearance, *veined* with red and white Gypsum, from half an inch or less to a foot or more in thickness, for many feet below the summit; and from what I have been informed by my friend Mr. Murray, it should seem that it has much the same appearance at the beautiful grove near Clifton Hall in Nottinghamshire, the seat of Sir Jervas Clifton. The Marle varying between these veins, which are often very broad, is commonly called Red-rotten-stone-rock *, and is sometimes intermixed with a greenish, more or less indurated, Marle. The Red-rotten-stone-rock moulders on exposure to the air, and often leaves the Gypsum projecting in flattish shelves, which also sometimes moulder or fall down, sooner or later, according to their purity or some other circumstances.

The upper specimen, figured in this plate, is from Clifton †, with the Marle above and below it. It is often very red, as if stained with the Marle: the present is a greyish specimen, with the appearance of the Sulphate of Strontian found in a rock of the same nature in the neighbourhood of Bristol, where Gypsum is indeed sometimes found, but may be easily distinguished from that heavy earth, by its being so much softer and lighter. I chose this specimen for the sake of comparison. This finely fibrous variety,

* The substance has nothing in common with the Rotten Stone used by the lapidaries, *tab.* 240.

† I have specimens from Forth River, near Belfast, by favour of Mr. Drummond.

and the coarsely striated one, may make several degrees to the more compact or amorphous sort one way, or to the crumbly or dusty the other way.—This latter is said to be washed from the Gypsum in the rocks, and is called Gypsum earth, but is a mere variety, and seldom occurs: indeed it would seem rather remarkable if it should remain long in a dusty state, especially as at the Baths of St. Philip, in Tuscany, the stream deposits the Gypsum as it passes, so as to make casts. This is now so contrived as to deposit it with the greatest nicety into moulds of the neatest workmanship, when generally the basso-relievo medals or figures taken out, are as hard as those made from baked or manufactured Plaister of Paris, as it is usually called.

Gypsum has been in use for ages as a manure, and is now become very fashionable, large manufactories being established for grinding, and patents taken out for the preparation.

TAB. CCXXXVII.

BARYTES sulphata.
Sulphate of Barytes.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Barytes. *Spec.* 1. Sulphate.
Var. Crystallized.

SULPHATE of Barytes from Surry seems not very generally known: I was first informed of it by my kind friend Mr. Warburton. It is perhaps rather remarkable for its bright brown or candied sugar tint, and, I may also say, for its being suspended in the midst of the Fuller's Earth—see *descr. of tab.* 231—in masses of about 100 pounds in weight; the whole generally very irregular on the outside, and more or less coated with Ochre, and incorporated with the Fuller's Earth, which is not so pure within two or three feet of it, therefore the proprietors of the pits do not desire to meet often with this Sulphate.

When these lumps are broken they are found to be a mass of different-sized crystals, crossing and interrupting each other continually, and sometimes distinct, of various modifications. I was, it seems, particularly fortunate in what I met with when I visited the place in 1805. I found in two lumps most of the modifications from and with the primitive, including two facets not yet mentioned by any author. One part of the lump was particularly beautiful. The annexed figure is taken from a fragment of it, and will

give an idea of the manner in which they lie. The darker sides of the prisms with the Pyrites * are chiefly primitives. The broader white † faces are truncations, as it were, of these, and have little irregular cavities with somewhat stellated Carbonate of Copper. On some sides there are minute, bright, iridescently golden-tinged, rust-coloured rhombs of Carbonate of Lime, which Count de Bournon took notice of in my museum when admiring the specimen. There are also darker ones passing to dark brown, and nearly or quite black. Some very pale Amethystine Quartz is occasionally found in the interstices, which sometimes has the impression of the Barytes.

The faces in this specimen are best to be understood by the geometrical figure.

Since writing the above I have met with a specimen in which an interrupted crystal about six inches long lies partly imbedded in the gangue of the same, and is of a very fine strong bright vinegar colour, but so well relieved as to appear equally bright, if not brighter, than the finest jewel set on foil.

* The Pyrites, which is generally of a brassy yellow, was found from the octaëdron to the cubo-octaëdron in much variety, elegantly embossing the faces.

† The opaque whiteness of the faces seems to be a crystallization with a smaller proportion of the water or solvent.

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TAB. CCXXXVIII.

BARYTES sulphata.
Sulphate of Barytes.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Barytes. *Spec.* 1. Sulphate.
Div. 1. Crystallized.

When any thing unusual comes under our investigation, it is a pleasant task to account for it if we can. Subjects of the present nature may not be uncommon, therefore it is the more convenient to comprehend them. The specimen here represented is particularly interesting and instructive, as the forms are strikingly curious, and show the tendency of the molecules to form according to the laws of Crystallography, notwithstanding certain interruptions. In this instance the gravity of a quantity of Sulphate of Barytes in solution has seemingly caused it to settle in contact with a loose powder, consequently having more air in its interstices, which, as the Barytes subsided, has risen into the substance, and, in part, interrupted the mass, while at the same time it gives them particular forms and a curious appearance; some of the powder filling them up more or less towards their bases, which are sometimes quadrangular, but mostly hexangular—see *the right hand figure*—where it appears that the greatest part of the hollows and the larger sides of their bases are diagonal to the primitive fracture. The variety in the forms of the hollows are in-

numerable; and there are some hair-like appearances on the tops of some of them, which are bending or otherwise modified: in the point of one is a little black speck like soot. The specimen has broken rather conchoidally, but not far from the primitive fracture. The somewhat zigzag line is interruptedly six-sided, depending on the particular interruption of the primitive molecules, and is chiefly filled with the same powder as the others; whence its opacity. It is not much unlike in the angles to *the bottom figure of tab.* 72, and is remarkable for its contrary and prostrate appearance; and the combination of the two might lead the imagination very far, of any one who had not attended to Crystallography. I mentioned in the description of *tab.* 71 the water or liquid in the little hollows of this substance. I add an outline or sketch of them at the bottom of this plate, as hitherto they appear to be a great curiosity. The hollows are rather irregular, a little angular, and have sometimes more or less tendency to the form of crystallization. The air bubbles of course upwards, in whatever position they are held; but in the long one it only moves the space marked with dots.

I have specimens of solid crystals of Sulphate of Barytes covered with, and passing into one another; and so it happens with different substances; but these I thought sufficiently remarkable to illustrate the present phænomenon, which may be very useful. Both these specimens serve to show the double refraction completely through the columnar sides. Thus the bubbles and hollows are seen double as in *the bottom specimen*—see *the magnified figure.* And where we can look into *the upper specimen,* the pyramids and odd forms may be seen double.

These specimens are from near Alstone Moor, Cumberland, and are in the possession of ——Walker, Esq. I have specimens with Copper Pyrites in spiculæ, hair-formed, &c., in them.

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TAB. CCXXXIX.

BARYTES carbonata.
Globular Carbonate of Barytes.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Barytes. *Spec.* 2. Carbonate.
Div. 2. Imitative.

SULPHATE OF BARYTES has been represented in *tab.* 96 of a globular form, and I believe it was thought almost a distinguishing character of the substance. Since Carbonate of Barytes has occurred in globular forms also, it becomes necessary to show the distinction, as we do not know that it has been before observed by any author. According to a specimen I have received from Dufton in Westmorland, which is rather a wedge-shaped fragment—see *the back figure*—they may be tolerably large, as this fragment, which seems to have been part of a ball, being near six inches long, promises some of a larger formation, and I have seen some balls pretty perfect, from one to three or four inches in diameter. An opaque roughness generally occurs on these nodules, which sometimes show a tendency to crystallize in six-sided prisms, either with or without six-sided pyramids*, or only with part of a six-sided pyramid, the end being truncated—see *the top large specimen* and *part of the smaller*. I do not show the most distinct, as in those, they

* Such as *tab.* 109, being, however, very rare.

are easily distinguished. The fractured parts have something of a columnar radiation; but very indistinctly and massively incorporated, and the fracture is otherwise small or largish, irregularly splintery, without any sign of internal crystallizational fracture. This is so peculiar to Carbonate of Barytes, that it was chiefly known from other substances by this mark, before it was found formed in external crystals, although that had not been particularly described. I have a large piece of radiating Carbonate of Lime from my kind friend F. Hall, Esq., of Arkendale, fourteen inches long, on the face of which the appearance so far corresponds with Carbonate of Barytes, that many good mineralogists have doubted which it really is; but the fracture of Carbonate of Lime soon exposes it. Carbonate of Barytes, or Witherite, may thus be in part known by its fracture. I have had dark specimens with Pyrites in it so coloured by the Iron, that, for want of the above observation, they would not have been known from Carbonate of Lime.

Oct. 1. 1807 Publish'd by Ja. Sowerby London.

TAB. CCXL.

Rotten Stone.

In Derbyshire, about two miles west of Bakewell, is found some variety of this remarkable substance in land belonging to the Duke of Rutland. It is said to be found also in Shropshire and Somersetshire, and I have a seemingly chance specimen from Sussex, by favour of Mr. Borrer. Near Bakewell it is found in broken nodules or fragments in the upper soil to about eighteen inches deep or more. It should appear that some parts of the rocks in the neighbourhood are in a state suited to a certain decomposition, by exposure on the common surface, mouldering in a peculiar manner into a more or less coherent, fine, dusty, soft, but somewhat granular appearance. The rock varies from a light brown to a deeper and grey or blackish hue. In decomposition it becomes lighter, and passes from dark to light yellowish brown, in which state it is commonly called Rotten Stone. It is sold to be used in manufactories for polishing metals, &c.; but is more particularly necessary to the lapidaries *, who polish the harder stones with it, by the help of water, and the substance of their machine being of a harder or softer metal according to the nature of the stone, as Lead, Copper, &c. Nature in this, as is always invariably the case, has furnished us with a substance so nicely suited to this particular purpose, that it

* Lapidaries sometimes cut and polish the more curious glass, imitative of precious stones (commonly called paste); but this is considered as rather degrading to the profession, and it might seem degrading to the glass polishers to teach them to polish glass. Rotten Stone is certainly so hard in its nature, as rather to grind the glass, as they would call it. Putty is used for polishing glass. It is an Oxide of Tin.

is an error in any author to place it indiscriminately with Tripoli; at least with that from Tripoli, which is sold in the shops for polishing (chiefly metals); and being now rare, they recommend Rotten Stone and Crocus Martis *, &c., for those purposes; although neither the Tripoli nor the Crocus Martis would at all suit the true lapidary.

The upper specimen is part of an irregular flattish fragment of a lightish colour, begining to decompose. *The middle figure* is part of a nodule decomposing on the outside: the curved line in the middle is part of a petrified shell, which is composed of Carbonate of Lime. The darker part is hard, looking like black Limestone (and much resembles the black Calp of the Irish, having also a similar fœtid odour, quite offensive when scraped); but that is of a texture more durable, else it would not be used for tombstones and paving.

The lower specimen is probably altogether Rotten Stone, or wholly decomposed rock, although it cannot be positively known by outward aspect, as even the best lapidaries have experienced.

Mr. Richard Phillips has analysed the Rotten Stone, and kindly favoured us with the result, as under;

Alumine	86
Silica	4
Carbonaceous matter .	10
	100

Tripoli is said to contain

Silica	90
Alumine	7
Oxide of Iron . . .	3
	100

although the Alumine and Iron are in general in greater proportion.

* A rust of Iron, now often called Tripoli; rendering the true Tripoli more obscure.

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TAB. CCXLI.

SILEX Quartzum.

Crystallized Quartz.

Class 2. Earths.	*Order* 1. Homogeneous.
Gen. Silex.	*Spec.* 1. Quartz.

Div. 1. Crystallized.

THIS curious specimen was collected long since by our late worthy friend Mr. W. Day, in Derbyshire; and as we have not seen the like elsewhere, we consider it as a valuable specimen. It is not uncommon to see Quartz on Galæna; but when it occurs in eighteen-sided crystals fairly terminated at both ends, the prism elongated, and mostly perpendicular upon all the faces of the Galæna, whether the Galæna be cubical or octaëdral, it is very remarkable. Indeed the Quartz in general appearance resembles small seed or grains, which, when perfectly well crystallized, are not common. They are sometimes dispersed, though adhering in bundles to each other, as figured at the bottom of the plate, and occasionally terminated by three-sided summits.

TAB. CCXLII.

PERHAPS this is one of the most remarkable crystallizations ever observed in Quartz. As the ends of the primitive rhombs—see *tab.* 41—are so scarce, this specimen is the more curious, having them dispersed about it. It is particularly so, for their being as it were nearly mackled, or in pairs, making a bifid-ended crystal, which is partly a series of these depositions, undulating in a somewhat step-like manner, as if formed on each other, sometimes with scarcely any prismatic sides, except at the lower ridge of the opposite rhombs. Sometimes they are nearly trifid—see *figures* 1, 2 and 3. Besides these there is a very odd formation in two places, much resembling the semicircular ends of bivalve shells, partly gaping, like the fruit of some *Banksiæ*, for instance of *Banksia conchifera* of Gærtner. These have smaller crystals on their outside, like the others; they are rather concave within, and a little convex without. This specimen was sent me by my kind friend John Stackhouse, Esq., among others favours, from Cornwall. The whole specimen is Quartz, a little coloured by Oxide of Iron, although at the back in some parts it is darker, and there are one or two crystals of a red tint with triedral ends, which correspond with the characters of the Eizen-kiesel of the Germans—see *tab.* 219. This odd mackled formation of Quartz it was the more necessary to figure, as the rhomb referred to was scarcely known, and much less so deceiving a crystal as this, if I may so call it, which has but little of the usual appearance of Quartz.

Dec. 1817 Publish'd by Jas. Sowerby London

TAB. CCXLIII.

ARGILLA hydrata.

Hydrargillite.

Class 2.	Earths.	*Order* 1.	Homogeneous.
Gen.	Argill.	*Spec.*	Hydrate of

Div. 1. Crystallized.

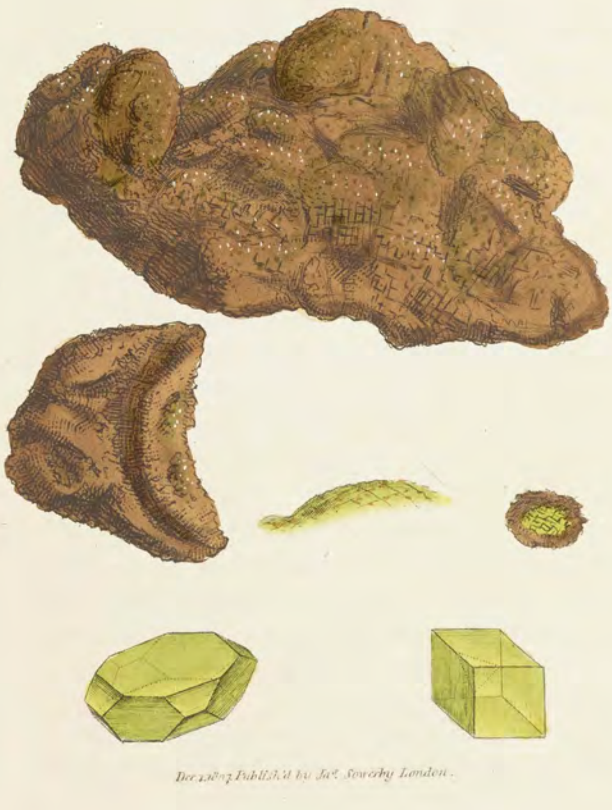
WE feel much pleasure in presenting our friends with a figure and account of the most perfect and rare specimen yet found of this substance, and particularly so, as its crystals are very neat and perfect on all sides, although they will yet try the patience of a Crystallographer to make them out, since they are so small, clear, brilliant, and dazzling to the sight, like Diamonds, that their facets become multiplied. However, with a moderate light and good glasses they may be distinctly understood. At first sight they much resemble the octaëdral crystal of Sulphur, with the apex of the pyramids truncated*. The Rev. Mr. Gregor was so good as to inform me that this mineral was raised

* Although the largest crystals are not above half a line in length, yet my son was enabled to measure the angles by the help of a microscope; and as he performed this by a new method, I mention it for the sake of such as might find such a mode useful. It is by placing the crystal in the forceps, or by any other convenient way, under the microscope, using one eye to examine the angles, while with the other they are compared with other large ones formed on paper, and placed several inches below; so that when a second line is drawn on paper, only differing a degree or two, it may readily be ascertained which is the most correct. The error of course cannot be much, and this is a perfection which I believe has not been before attained; nor could it have been expected, in such minute crystals.

from the mine called Stenna-Gwyn in the parish of St. Stephen near Branwell in Cornwall, and that the crystals, besides Water and Alumine, as the principal ingredients, contain Lime and Silica in small proportions. One of these latter ingredients (or perhaps both of them) is probably united to Fluoric Acid. This acid, as well as the Lime and Silica, seem to exist in a somewhat larger proportion in this fossil than in the common Hydrargillite. Some of the crystals were put into a platinum crucible, and Sulphuric Acid dropped upon them. On exposing the vessel to a moderate sand-heat, the vapour of Fluoric Acid* was extricated; a piece of glass was put on the crucible, and a saline crust was deposited on it, which consisted of Fluoric Acid and Silica: as the surface of the glass was not corroded, it is inferred that the Silica was detached from the fossil. The Sulphuric Acid effected a solution of the whole, except a small portion of Silica. On the evaporation of the fluid, some Sulphate of Lime was separated, as well as a little Silica; on adding some Potash to the remaining fluid, crystals of Alum were from time to time produced, after repeated evaporations, to the last drop.

The angles of the mutual bases of the pyramids were found to be about 102° and 78°. The faces of the pyramids were near the base about 78° and 65°, making the summit 37°. The depth of the truncation, which is a primitive face, varied. The nucleus is a cube.

* Mr. Davy has some time since determined that a small portion of Fluoric Acid, in a peculiar state, exists in the Devonshire Hydrargillite.



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TAB. CCXLIV.

A R G E N T U M muriatum.
Crystallized Muriate of Silver.

Class 3.	Metals.	*Order* 1.	Homogeneous.
Gen.	Silver.	*Spec.*	Muriate of

Div. 1. Crystallized.

SPEC. CHAR. Oxide of Silver combined with Muriatic Acid.

SYN. Argentum corneum, Hornertz. *Linn. ed.* 13. *t.* 3. 148.
Mine d'Argent cornée. *De Lisle, t.* 3. 463.
Hornerz. *Emmerl.* 2. 168.
Corneous Silver Ore. *Kirw.* 2. 117.
Horn Silver. *Babington*, 150.
Argent muriaté. *Haüy*, 3. 418.

THIS valuable specimen was brought me by its owner John Williams jun., Esq., who had it from Mexico mine in Cuthbert parish, Cornwall, found at about eight fathoms depth. The crystals in this substance are always very small, but in the present specimen are very easily determined; they are cubes and cubo-octaëdrons, either regular or elongated, and more or less deeply truncated. They are in some parts distinct, in others more or less confusedly huddled together, others filling the hollows in smaller varieties, or confluent in them. The peculiar texture of this mineral has given it the apt name of Horn-Silver: it is, however, peculiar to itself, and rather like softened horn, inclining to waxy: hence it may be indented by the finger nail, and takes the impression of any equally hard substance. It feels less hard or harsh than horn in cutting, and receives by the instrument a waxy polish. The crystals break easily with an irregular conchoidal fracture, not unlike Quartz, but perhaps in a blunter manner, and shining like the

common surface. They vary in colour from a light olive to a dark green, and are rather more transparent than wax, which otherwise they much resemble. The specimen gives out an odour like that sometimes inhaled on the sea coast. The matrix is chiefly cubic Sulphuret of Lead and brown Ochre. My specimen, which has the elongated crystal No. 3, is principally composed of Quartz with some spiculæ of Carbonate of Lead.

The Corneous Silver Ore is composed, according to Klaproth, of

Silver	65·75
Oxide of Iron . .	6 00
Muriatic Acid . .	21·00
Sulphuric Acid .	0·25
Alumina	1·75
Lime	0·25
	95·00

Its specific gravity is from 4·745 to 4·084. Brisson says 4·7488.

The Silver may be very readily extracted from this ore on Charcoal, with the addition either of Iron or of a fixed Alkali, by the blowpipe, when a fœtid odour passes off, and leaves the Silver in a globule or globules *.

It is found in France, Spain, Norway, Hungary, Bohemia, and Siberia, and also in America; but Cornwall is the only county in England, or indeed in Great Britain, in which it is found. This mineral was once very abundant there, and the Silver produced from it has been wrought into a tea-table equipage, &c.

We are the more obliged to Mr. Williams for the use of the present specimen, as it clearly elucidates the form of the crystals, which were scarcely determined before.

* One of my specimens has the Silver so mixed with Ochre, as not to be discerned by the eye. When a morsel of this was heated red hot, the Silver oozed out in minute globules, giving the fragment a very pretty appearance: rubbing gently with moistened Zinc also detects the Silver, by reducing it to the metallic state.

Dec.1.1807 Published by Jas. Sowerby London.

TAB. CCXLV.

QUARTZUM argillaceum.

Common Clay.

Class 2. Earths.	*Order* 2. Mixed.
Gen. 2. Pulverulent Quartz.	*Spec.* 1. Mixed with Argilla.

SYN. Potters Clay. *Kirw.* 1. 180.
Clay. *Bab.* 50.
Argile glaise. *Haüy*, 4. 442.
Loam, Potters Clay, Pipe Clay, and Variegated Clay. *Jameson*, 1. 301.

PIPE CLAY.

THE best Pipe Clay (*upper figure*) is from Teignmouth in Devonshire, and is used in large quantities (being washed, and made plastic with water) for forming tobacco-pipes, and mixing in various sorts of pottery, at Vauxhall, &c. Much the same substance is found at Cambridge, called Gault, and is used for similar purposes, and of the more sandy sort are made whitish tiles and bricks. These nearly resemble the Flanders and Bath bricks *, as they are called; now I suppose a great and profitable article of trade, as they sell at a good price, 4d. each, for cleaning knives, &c.

Pool, in Dorsetshire—see *middle figure*—has much of this Clay, but rather inferior in quality in general.

Alum Bay in the Isle of Wight and Holyhead in Wales —see *lower figure*—afford Clays of this kind, besides many other parts of Great Britain.

* Which only differ in containing a much greater quantity of Sand.

Clay in common is best characterized when wet and soft, in which state it is most generally found below the common surface of the Earth. It is known by its plastic qualities, and fitness to be formed into any shape. Thus specimens of common Clay are scarcely to be described by their fracture, and, being generally gathered in a moist state, have the marks of the tool, and are frequently made into balls or squares. Their tenacity, however, gives them a raggedness in breaking, rather peculiar to themselves, smoothest on the sides, and somewhat roughish or earthy; but when dry it varies much, according to circumstances, and is sometimes a little conchoidal. It is chosen as white as possible for pipe-making, and for the finer purposes, and certain proportions of different kinds are used to suit the intention of the potter. For making tobacco-pipes it is burnt or baked so as to stick to the tongue or lips, but is sometimes polished. In making china it is generally more baked and smoother, which adds to its hardness. This is said to be the best Clay for glass-house melting-pots. It is often used in the composition of artificial stone, and for cleaning cloth, wool and leather.

Pure Clay is said to have been found at Halle, in Saxony, but some doubts have arisen as to its being natural. This, according to Fourcroy, is composed of

Alumine	45
Sulphate of Lime . .	24
Water	27
Silica and a Muriate .	4
	100

Dec.1.1807. Publish'd by Jas. Sowerby London

TAB. CCXLVI.

Brown Clay.

Bricks, tiles, pans, and garden pots are most commonly made of these brown Clays, which do not differ much in quality. The lighter brown Clays generally make the lightest-coloured bricks, their texture chiefly depending on the sand. The common brown Clays are preferred for modelling at the Royal Academy, &c. *The upper figure* represents a specimen of good red brick Clay, which was found 85 feet below the surface of the ground in Richmond Park. Sometimes the beds of Clay lie more in strata than at others, and when out of their places separate in a slaty manner. A specimen found at 138 feet of depth at the same place, is something in this manner—see *the middle figure*—which is rather grayer-coloured and more sandy, and is generally called Blue Clay; taking its name from the blue cast it has when fresh dug. This probably proceeds from the blue or gray Oxide of Iron, which soon bleaches. I have seen it where there have been rifts, allowing passage for water, when, in the parts where the light did not enter, it has shown the most vivid Prussian blue and purplish tints; but these on exposure to light passed off in a few minutes. All wet substances are darker than dry ones; but in these it is most remarkable—see *the darker blotches on the left hand of the figures.*

The lower figure is a sort of Clay, which generally has more or less red or reddish brown sand in it, and is used in great quantities for making coarser pans, garden pots, &c. It is little else than a stiff loamy Earth of the farmers, when it is too coarsely mixed with gravel for the potters, which at the same time is convenient for the purpose of the former, and helps to separate it for the growth of plants. A little addition of common gravel might sometimes greatly help such a soil, and be a little saving as to the quantity of Lime. Good oak lands are nearly of this nature.

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Dec. 1. 18[illegible], Published by [illegible] London

TAB. CCXLVII.

Coloured Clays.

Oxide of Iron seems mostly the colouring ingredient in Clays as well as in most other substances. *The upper specimen* here figured is of a peculiarly delicate brown, with some greenish parts about it, and has a little of the fracture and appearance of Fuller's Earth. It, however, is a very good Clay, readily plastic with water, which is sufficient to distinguish it from that substance. In this the green hue was stronger when first gathered. This came from the canal near the Kent road. It is not rare.

The middle specimen came from a well in Richmond Park *, with colours as beautiful as any of Seps Marbles. The lilac tints may be ascribed to a portion of Manganese, the usual cause of crimson and purple tints. It may, however, be owing to a mixture of two different Oxides of Iron, viz. the reddish, and the blueish or grayish. *The lower one* † displays also the bright Ochre red so mixed with the white and yellow, that we might almost call it Terra miraculosa or Wonderful Earth, if that name were not already engaged by a Lithomarga found at Klanertz, of which we shall not fall far short when we exhibit the Lithomarga from Ireland. In *the middle figure, the upper surface* is rather more polished than ordinary, and appears as if one mass had slipped over another. This is not uncommon in many fossils; for, when two substances pass over one another, they give each other a smoothness which is called Slickensides, as in Ores of Lead, &c.

* 390 feet below the surface.

† 408 feet from the surface.

Dec. 1. 1817. Published by Jas. Sowerby London.

TAB. CCXLVIII.

QUARTZUM argillo-pyritaceum.

Pyritaceous or Alum Clay.

Class 2. Earths. *Order* 2. Mixed.
Gen. 2. Farinaceous Quartz. *Spec.* Mixed with Argilla and Sulphuret of Iron.

SYN. Pyrito-bituminous Aluminous Ore. *Kirw.* 2. 17.
Argillaceous Schistus. *Bab.* 62.*
Alum Slate. *Jameson*, 1. 323.

THE Alum Clays vary much at the different places where they are found, and may be divided into many tolerably distinct varieties, from the appearance of common black Clay to a more slaty one, more or less indurated. They do not adhere to the tongue, nor take a polish readily by being rubbed with the finger nail, but rather a crumbly whitish streak. Aluminous Clay is sometimes glossy with a slaty fracture, but otherwise very dull, except having some glistening particles of Pyrites.

Some sorts effloresce readily in the common air—see *tab.* 23 and 24—and some become covered with a whitish tasteless powder. The mixture, like other Clays, may contain many adventitious substances, particularly vegetable and animal. At Whitby*, Bolton and Stowbrow works, in Yorkshire, vegetable impressions, the remains of wood and various shells, are found in the Clay. I have very curious specimens of the different changes of vegetables, from Whitby, in petrifactions from bituminous coaly formations to the finest plank jet, if I may so term it, and some curious shelly remains, of which last sort are the *Cornua ammonis* —see *tab.* 30—which are commonly called Snake-stones; and to favour the idea, the people who gather them form one end into a kind of head.

Among the remains of shells, some there are almost all Pyrites; as the specimen now figured, from Whitby, being the remains of a large Pecten or Ostrea, is formed with

* Babington's specimen from Whitby appears from its colour to have been roasted.

two or three coats of Pyrites. I have therefore exhibited it for its novelty, as it will very well show the nature of the Clay at the same time. As I found a species of *Arca*, new to me, I add a figure, as I believe they are not uncommon there, though not, to my knowledge, elsewhere; therefore they may identify something of the geology of the spot, as well as add to our information in this department.

It somewhat depends on the nature of the ore to vary the means of obtaining the Alum from it. It is mostly burnt and well watered, and to the water, when saturated, is added Muriate of Potash, or some other Salt, sometimes an Ammoniacal Salt; it is then left to crystallize, which the Alum usually does in masses terminated by four-sided pyramids. In the last act of crystallization it forms the other half of the octaëdron more or less perfectly with truncations, and sometimes crystals so piled on each other, side by side, that the workmen call them Alum towers, making handsome ornaments under a glass; but these should not be exposed to the sun, nor to much warmth, as they will then lose their beautiful transparency.

The Alum stone of Tolfa* in Italy is found to contain

	By Klaproth.	By Vauquelin.
Silica	56·5	24·00
Alumina	19·0	43·92
Potash	40·0	3·08
Sulphuric Acid	16·5	25·00
Water	30·0	4·00
	162·0	100·00

The Roman Alum is sometimes found in small crystals of a reddish cast, and is well known in shops. The nature of the British Alum might infer its containing some Ammonia, otherwise it differs only a little in the proportions, and in containing a slight foreign mixture, as it is little else than Clay and Pyrites. Sometimes particles of Mica are found in it.

Clays, which seem too common almost to claim attention, whether mixed with the spoils of the most precious rocks, plants, or animals, or with more humble materials, are still enriched to serve some future purpose; and according to Shakespeare, at the worst, it may, like the noble dust of Alexander, still serve to close a bunghole, or, like "Imperial Cæsar, dead and turn'd to Clay, might stop a hole to keep the wind away."

* This, as may be inferred from the analysis, requires no addition of Alkali to make it crystallize. It seems very different from the British.

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Feb [illegible] Published by Ja.s Sowerby Lond.

TAB. CCXLIX.

ZINCUM Oxy-sulphureum.

Oxy-sulphuret of Zinc.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 6. Zinc. *Spec.* 3. Sulphurated Oxide.
Div. 2. Imitative, mammillated.

SYN. Blende. *Dr. Kidd in Nicholson's Journal*, *v.* 14. 134.

WE are glad to give a figure of a new substance to the mineralogical world, by favour of Richard Phillips, Esq., especially as it has been analysed by Dr. Kidd. Its first appearance gave rise to many queries; for the workmen who found it considered it as wood-tin, but its resemblance to some of the blistered Copper Ore from Cook's Kitchen, &c. excited different ideas. Dr. J. Kidd shows it to be an Oxide of Zinc with a largish proportion of Sulphur. I believe only one variety has been found, and this has always in some degree a bubbled appearance; the bubbles more or less solid, with a variety of tints, from dark dull yellowish brown to nearly white, and rather irregularly coated. The fracture is rather conchoidal, not striated, with a waxy appearance. Externally this mineral is light yellowish, often smoky or dusky grey, sometimes with a bloom like a plum, or varying to a dull crimson, occasionally somewhat iridescent.

The specimen figured is on a matrix of Arsenical Iron and Quartz.

The analysis by Dr. Kidd gave

Oxide of Zinc .	66
Sulphur . . .	33
	99

This gentleman also found a Platinum crucible rendered fusible by it; we suppose, in consequence of the great quantity of Sulphur which it contains.

Huel-Unity and one or two other mines in Cornwall have lately produced this substance.

The Oxide of Zinc, *tab.* 202, *lower figure*, is somewhat like the above; but we do not suspect it of containing any notable proportion of Sulphur, if any.

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Feb. 1.1821 Publish'd by Ja^s. Sowerby London.

TAB. CCL.

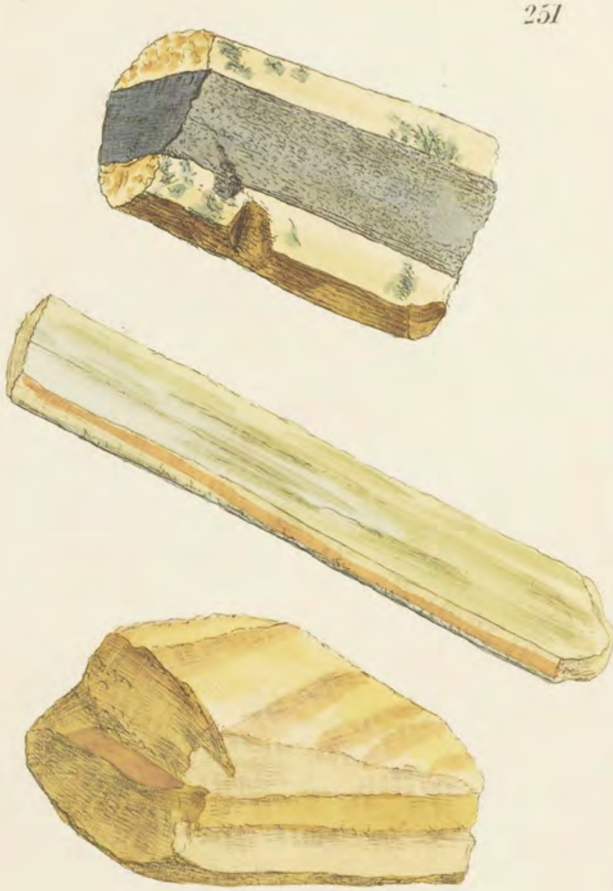
SILEX quartzum.

Div. 2. Imitative.

THIS might be called a Jasperine or Porcelain Flint, and is extremely curious, as having taken place of a *shell* much resembling *Venus Islandica*, and seems merely to differ in being deeper. This appearance is rarely found, especially in the place, as it were, of the shells themselves.

The top figure shows fragments of an Escallop, looking like recent ones, but are of a most compact Silex, semi-transparent like the natural shell.

The lower figure shows a transverse piece, separated at the crack, with somewhat dendritical veins, giving the appearance of China. It has also the cast of other shells that were involved in the same catastrophe. The Rev. Dr. Beeke was so good as to favour us with this curious specimen, which was found at Little Teignmouth in Devonshire; and the Rev. Dr. Sutton has favoured me with a shell, probably of the same species, from Elmsett in Suffolk, but little changed, being nearly like such as may be found exposed, and dead, on the coast. It has some fragments of *Sertularia* with Lime and Gravel about it. I have some of the same, which I found at Sydenham when the canal was digging there in the year 1805, in a marly Septarium. So we may trace the same shell at very different places; which will not only be a help in geology, but will show at one view the varieties to which Flint is liable, and not only that it may be capable of taking casts or impressions, but be in different states during that operation. In this instance it seems to have been considerably diluted, as the dendrites (if I may so call the red lines) are much attenuated.



Feb 1 1808 Publish'd by Jas Sowerby London

TAB. CCLI.

LITHOMARGA.

Class 2. Earths. *Order* 2. Mixed.

SYN. Lithomarga. *Kirw.* 1. 187.
Argile lithomarge, Argilla crustacea. *Waller*, 1. 49.
Stein-mark. *Emmerl.* 1. 355.
La Moelle de Pierre, ou la Lithomarge. *Broch.* 1. 447.

THE substance which I find generally termed *Lithomarga* seems to be an argillaceous Steatite or Steatitic Clay. I gather this from the descriptions in different authors, although some are doubtful as to its containing Steatite or Magnesia, which generally gives an additional soft or soapy quality to it. The present specimens are from near Keswick in Cumberland. The provincial name is Moidal.—It more or less adheres to the tongue as it is loose, or indurated, and some parts of these specimens are more so than others. The *Lithomarga* feels smooth, with a slippery softness, its looser parts soiling the fingers and the harder parts not, the former readily making a streak on paper or any such substance.

The vulgar idea of Rock Marrow seems curiously analogous to *the upper specimen,* which resembles the bone also; the lightish part representing the latter and the darker the marrow*. It resembles a soft Slate, and we sometimes find veins in Slate much resembling the lighter part; *the central figure* is little else, coated with the grey variety as in the

* This somewhat agrees with the description of the Rock-Soap of some authors.

middle of *the upper one,* which just passes into the whiter part in small dendritical figures. They are both found near a slate quarry. *The lower specimen* is from Silver-bourn in the Isle of Man, where Lord James Murray informs me it is found in plenty. I do not know that any use has been made of it; when fresh it was hoped that it might serve as Fuller's Earth.

TAB. CCLII.

IRELAND affords many curious substances, and seems to abound with some varieties of this. The present specimens are all from thence, by favour of Dr. Scott of Dublin. The beauty of some of them give me an idea of the Lithomarga called *Terra miraculosa,* and may be, perhaps, equally beautiful.

The uppermost specimen is soft, and marks on paper readily and smoothly. *The middle one* is not quite so smooth, while *the lower one* is more earthy and rather gritty. It is remarkable for its purplish cast, probably caused by a mixture of the red and black Oxides of Iron.

The middle figure is coloured with red Oxide of Iron, holding the little whitish waxy granular fragments of almost perfect Steatite, as Trapp sometimes does Zeolite.

The lower figure is of a brighter purple than *the upper one,* and the little specks of a similar waxy Steatite give it a remarkable and pretty appearance. Some of these, Dr. Scott informs me, are of a nature to bear turning in a lathe. They are found in the county of Antrim; some near Temple-patrick, accompanying the Basalt in the Dykes, which from its crumbling state is provincially called Rotten-rock. An exposure to moisture will naturally produce this effect on the softer mixed Steatites, as well as on Lithomarga.

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TAB. CCLIII.

ARGILLA ferrifera.

Ochre.

SYN. Colorific Earth. *Kirw.* 1, 194.
Yellow Earth. *Ditto.*
Gelberde. *Werner.*

WE are often led to seek at a distance natural productions which are to be found near at hand, and perhaps in the greatest perfection at home. Thus it happens with some Ochres. Mr. Kirwan among his colorific Earths, *vol.* 1. 193, 194, speaks of Yellow Earth; and other authors speak of it also: all which nearly agree with our common English Ochre, which is equally useful, and is often the best that can be procured. This is called Stone Ochre, and is used by artists, painters in oil chiefly. It is not mentioned as such in general, except by Sir John Hill, who has said enough of Ochres to confound the artists in their choice, particularly as he recommends so many.

I here show some varieties, both for the curious mineralogist and the artist. Earths most useful as colours are generally most durable *.

The upper specimen is not fit for that purpose, as it is rather of a loose texture, separating in water, scarcely smooth, and is rather a half-mixed imperfect Ochre.

The middle figure approaches nearer to an useful Ochre; but is rather too loose and gritty. It is a variety brought me by Lady Hippesley from Somersetshire, where there

* The Patent Yellow is useful and durable in oil-painting, but in water it soon blackens.

was tolerable plenty. It might occasionally be worth while on some estates to assist the progress of nature in forming Ochres, &c., and a good and instructive lesson may be learned on this head at Shotover Hill, from whence comes *the lower specimen*, which is more perfect, and gives a glossy surface where cut with a knife or rubbed with the nail, breaks somewhat conchoidally, but rather ruggedly, and is quite necessary in oil-painting. It is often found very fine at Shotover Hill near Oxford, from whence my specimens were brought, by favour of Dr. Williams, where it is curious to see the ochraceous Iron with Clay filtering naturally through a stratum of Sand; they are the best I have seen, especially for the use of landscape-painters, who use this substance as a yellow, or red, which latter colour it assumes on being burnt, when it is scarcely altered except in colour.—It is found in many other parts of England, but in general of an inferior quality. This Ochre is commonly called Yellow; but, for the sake of some accuracy with regard to colours, I will take the liberty to say it is rather a dull reddish yellow; and as the substance itself will not serve well to use as a water colour, it was found necessary for representation to put red and blue to good Gamboge, which is perfect yellow *.

That of Upper Saxony is said to contain of

Argill	50
Oxide of Iron	40
Water acidulated by Sulphuric Acid	10

* See my New Arrangement of Colours, &c.

The coarser sorts of Ochres are often used for painting ships, being very durable.

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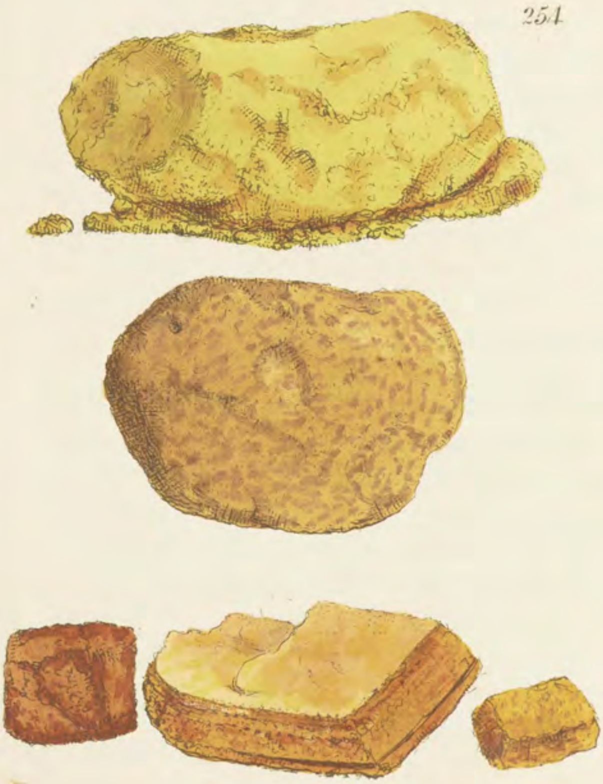

Feb. 1. 1808. Publish'd by Ja^s. Sowerby, London.

TAB. CCLIV.

I HAVE here figured some rather light mixed tints of Ochres, to show their varieties. They will all serve as paints, and might suit instead of mixing various substances to obtain the particular colours, when a considerable quantity of one tint is wanting; and they are more likely to be durable.

The upper figure, or Saffron Ochre, as it is called in Wales, is of a greyish cast from the mixture of a minute portion of black Oxide of Iron with the yellow Oxide.

The middle specimen came also from North Wales, and is of a deeper and peculiar tint.—These I received from my kind friend the Rev. H. Davies.

The lower figure represents an Ochre much resembling the Roman Ochre of the shops, and is easily procured. It is very useful in the warmish distant yellow in landscapes, &c.; but not quite so proper in delicate portrait painting, unless we attend to the nature of the substance, as it rather becomes deeper than fades, but after a day or two is very permanent.

I have seen this Ochre in the Isle of Dogs, and observed that it might be saved or formed at any time in many situations where Iron is present, or has been used in water. When procuring the Copper in Wales from the vitriolated waters it might be of some account.—I have had specimens from these works by favour of Lady Wilson, but do not know that it has been considered as an article of commerce; it is rather brighter than common Roman Ochre, consequently more valuable.—I know not that we have a substitute for Naples Yellow in England: most other earthy colours we have at least examples of, if they do not plentifully abound.

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Feb. 1.1808. Publish'd by Ja^s Sowerby London

TAB. CCLV.

THE Red Ochres *, often nearly the same in appearance with the Yellow ones when burnt, are occasionally found, and I have some even mixed with Yellow Ochre from Cornwall.

The upper right hand figure is perhaps a Steatitic Clay; Ruddle has more Iron in it. This and Venetian Red are nearly alike, both depending on a mixture, as it were, with Red Hæmatites—see *tab.* 56—or little else than Red Oxide of Iron. Both are found, or may be readily manufactured. The latter is a cheap and useful water colour, and the first answers many purposes; such as for a coarse oil paint for floor-cloths, or mixed with tar for paling, marking cattle, &c. It is of an earthy texture, rather loose, and is light and bright about the powdery part of the specimen.

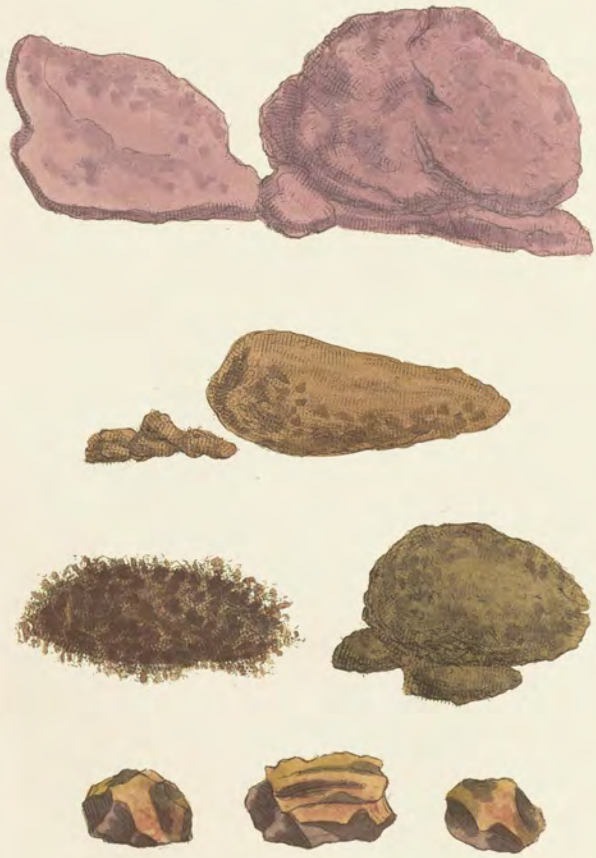
The left hand upper figure is found colouring imperfect Schist in the Isle of Man, and was sent me by order of the Duke of Athol.

The lower specimen is of a looser texture from Devonshire, by favour of the Rev. A. Neck.

The deep red specimen annexed came from the Basaltic Rocks near Belfast. It is there often much indurated, and passes into a quartzose or flinty substance, forming Eisenkiesel of the Germans.

The lower fragment is from the Isle of Wight, and would nearly agree with Eisen-thor, or Iron Clay of the Germans. Its colour may denote it an Umber; it has, however, a reddish cast. It leads pretty well to the next variety, *tab.* 256.

* Ochres, strictly speaking, perhaps ought only to be yellow, or yellowish. Common language, however, warrants the use of the words Red Ochre, as a name for this substance.



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TAB. CCLVI.

Having figured the Yellow as well as Red Earths, and mixtures of Iron with Clay, &c., commonly called Ochres, I venture to consider it as not very irregular, being in some degree natural, to exhibit the following varieties. These may, from their texture and nature, arrange with or near the former, and so complete the list of colours, as they altogether seem to be mostly regarded in that light; and it may serve as an example for the order of other substances, when they have any thing to do with colours, as to arrangement.—Thus I would place the lightest first, and as regularly as I could, the primitives, and then those derived from them. I have, in *tab.* 10, considered the light blue Iron Ore, merely as such, as it has little or no Earth but what may be considered as adventitious; and it might claim a place hereabouts, from its resemblance to a loose Ochre, and may seem necessary to help the purples on this plate. As purples *, dark browns, and nearly blacks, have scarcely yet been noticed, this may become instructive, as it is curious and natural. Whether the purples depend upon the same mixture as in the Clay—*lower fig. tab.* 252—I do not know.

The upper figured specimen came from the Isle of Wight; I was favoured with it by my botanical friend C. Lyell, Esq., and I have some from Wales nearly of the same tint, by favour of Lady Wilson. *The darker ones* I have received from various persons and places; and as they are really interesting, I shall be the more particular concerning them.

* Iron is understood to have but two sorts of Oxides, the black, or martial Ethiops, and the red, any other colour or tint being produced by a particular mixture.

It would appear, by the experience of Klaproth, that the blue Iron Ores, commonly so called, are the effects of Phosphorus; although Mr. Kirwan doubted it, as I have observed at *tab.* 10. The darker blue Iron Ore, called Native Prussian Blue, from North Wales, which I had with Mr. Day's collection, and also by favour of a friend, from near Aberdeen, are more solid, and darker, than that figured, and will serve to fill up the arrangement. I believe them to be nearly the same as to the colouring ingredients; this being more mixed with a darkish Clay, which gives it the appearance of Indigo Blue. Thus we see the three primitive tints may be found in Ochres, and more or less in the Clays, as some of the Welsh specimens have rather more Clay than others, although not worth a different specification; and the whole serves an important purpose, viz. to satisfy us pretty nearly as to what may be expected from coloured Clays, or Ochres, as I show the brightest I have seen of them.

That they may be mixed to form greens may sometimes happen in nature; but I have only seen it so in Clay, as mentioned and figured *tab.* 247. Greens seem more combined in another way, as with Chlorite, Terre-vert, or Talc, as *tab.* 182, *lower fig.*, and among the precious stones the Emerald is green, which is said to be caused by Oxide of Chrome.

Colours are only brilliant by means of the substance which reflects them, as I shall show in my New Arrangement of Colours.

Brown Earths are called Umbers; but are very much allied in their nature to the Ochres. Thus they may, with some regularity, be placed near them in this instance. Common Umber of the shops is of this kind, and will burn darker; hence we have raw and burnt Umber. Clayey Iron Stones often approach the appearance of the Umber used by painters, of which the best is said to

come from the Levant. I have three or more varieties, including a substance much related to it, and Cullen's Earth, as it is called in the shops, originally brought from Cologne in Germany.

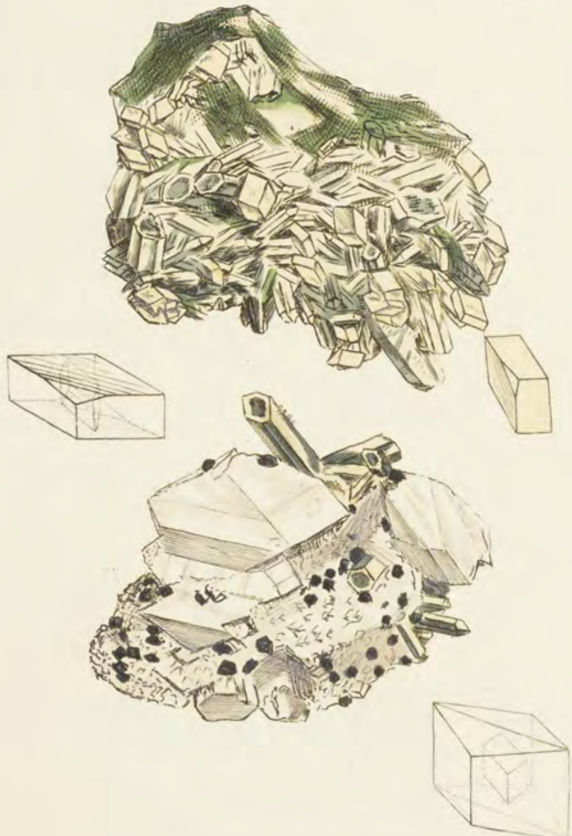
The second or *middle figure* in the plate is such as is sometimes found in the hollows of Quartzose rocks in moderate quantities. I have it from Devonshire, by favour of Colonel Montague. It seems to be an Oxide of Iron with the carbonaceous remains of vegetables.

The next right hand figure was sent me from Scotland; I have some also from Warwickshire, by favour of Lady Markham, found among the Ruddle. The Iron in most of them blackens when heated, and becomes magnetic, particularly in this last, and the vegetable remains are affected, something like Touchwood—see *the left hand darker powdery figure*. A more vegetable substance still is that resembling Colonian Earth, which I have along with petrified Wood and Jet. The form of the Wood remains represented in Stone, chiefly Quartzose, &c.; the Bitumen in the form of Jet, and the real Wood is as it were displaced in this earthy form. This more than commonly interesting specimen was sent from Kettleness near Whitby in Yorkshire, by favour of J. M. Sowerby, Esq.

The lower figure represents Terra Siennæ, a famous rich brown; chiefly an oxidized Iron. It was sent by Nathaniel John Winch, Esq. and his friend Thomas Crawhall, Esq. from Cheviot Hills. It is certainly a new addition to the mineralogical catalogue of Great Britain. It is generally found in small pieces, is brittle, and often with a sharpish and smooth or glossy conchoidal fracture, having occasionally loose grains of yellowish Ochre about it. It may be used in a more transparent style than those before mentioned, and will serve in the last spirited touch, to give a zest to the picture, and leaves it in the highest taste, especially suited to Rembrandt's style. Asphaltum, *v.* 2. *p.* 74,

occasionally supersedes the use of this; and that from Egypt is preferred: not but we have it as good, though not so plentiful—see *tab*. 139.

Thus we have a means of mixing all possible tints in a common earthy form well suited for earthy representations, viz. landscapes, and they have very fairly obtained their proper places in the hands of artists of that class.



Apr.1.1808.Published by Jas. Sowerby, London.

TAB. CCLVII.

SILEX Petuntse.

Feldspar.

The specimens here figured, from Cornwall, are curious, this formation not having till lately been known as British. Such specimens are very rare at present; the crystals not being imbedded, as is most usual; besides which, they much resemble the Feldspar commonly termed *Adularia* in general habit, although not so transparent as those commonly brought from the place which gave rise to that name. They are, however, whiter and more delicate than usual in those of British origin.

The upper specimen has many small crystals upon it, among Quartz and Chlorite, or Green Talc, which are scattered about the gangue, and occasionally crowded or grouped; but more commonly like *the right hand middle figure*.

The left hand middle geometrical figure shows the position of the primitive rhomb within the crystal here figured, two prismatic faces of which correspond with it, and the little faces of the corners correspond with the terminal faces of the primitive. The broader striated face forms an angle of about 90° upon the vertical edge of the prism, and the faces of the prism an angle of about 128½° upon each other.

The lower figure represents a valuable specimen from Huel Rose mine in the parish of Gwennap, Cornwall, which was lent me by my kind friend John Williams, Esq., who is fortunate in possessing many peculiarly curious Cornish minerals.

The position chosen to show most of this specimen gives it a very strange appearance, especially as so many crystals are situated very close to each other.

The lowest geometrical figure exhibits the position of the nucleus.

The matrix is partly composed of very small crystals of Feldspar, and partly of columnar Quartz crystals, with some irregular six-sided facets, forming the pyramids common to Quartz, which, in these, are often more transparent within than externally, giving them an opaque-coated appearance, depending perhaps on the water of crystallization.

Feldspar is in its forms extremely puzzling, but should be well understood, as we shall be the more likely to know it, if occasion requires, without analysing it, which will facilitate our inquiries into so important a substance, often so very useful in porcelain manufactories.—See *tab.* 211, 212, and 213.

Apr. 1.1808. Publish'd by Ja.s Sowerby, London.

TAB. CCLVIII.

SILEX fulgens.

Stilbite, or Foliated Zeolite.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* Stilbite.

SYN. Stilbite. *Haüy*, 3. 161. *Wern. Catal.* 267.
Blattriger Zeolith. *Emmerl.* 1. 204.
Foliated Zeolite. *Thomson*, 4. 316.
Zeolith. *Kirw.* 1. 278.
Zeolithe nacrée. *Lameth.* 2. 305.

BRITISH specimens of Stilbite are found chiefly in Scotland and Ireland. It may generally be known by the laminated texture of its crystals, which are often so small as scarcely to be distinguished without the assistance of a magnifying glass. The specimens figured came from Strontian. The crystals of *the upper one* are very small and confused, excepting a few that stand higher than the rest, and are scattered about the specimen. The other side of the specimen consists of Carbonate of Lime in six-sided prisms, with flat ends, being what is commonly called truncated—see *the right hand upper outline.*

These crystals of Carbonate of Lime must not be confounded with those of the Stilbite. It is somewhat remarkable that, of specimens which come from Strontian, Carbonate of Lime frequently occupies one side and Stilbite the other.

The crystals of Stilbite here figured, at first sight ap-

pear like six-sided prisms; but in fact are only four-sided. Two sides are generally smooth and flat, showing the laminated texture and internal pearly lustre; and the other two are striated, somewhat convex, and rather irregularly bevilled, often giving the crystal a six-sided appearance. The summits have also the appearance of being truncated, and have various parallel bevillings on them, giving them a convexity rather more prominent than that on the sides. They are somewhat transparent, and very little coloured.

The Carbonate of Lime and Stilbite meet, as it were, back to back, in the midst of the specimen. There is, however, a space which perfectly distinguishes them, the Stilbite forming irregular *spiculæ* meeting those of the Carbonate of Lime.

The lower specimen is yellower than usual, and the crystals are very distinct though small.

TAB. CCLIX.

THE prisms in this specimen are four-sided, and the two opposite sides that are parallel to the laminæ are broader than the other two: they are terminated by a four-sided pyramid with rhomboidal faces, which in some crystals are truncated at the apex. They line an irregular cavity in a fragment of a Basaltic column from the Giant's Causeway. I was favoured with it by John Templeton, Esq.

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TAB. CCLX.

Red Stilbite.

One sort of Red Zeolite, as it is commonly called, seems a curious variety of Stilbite; but I do not know that it has been recognised as such by any author on British fossils: indeed it is considered as very rare. The peculiar laminated form it assumes distinguishes it from the Zeolites in general, and gives the radii a very different appearance, as they lie over each other, resembling, in some measure, the flyers of a ventilator. The mica-like lustre of the substance gives the reddish orange a peculiar pleasant cast, although nearly void of transparency.

Since my figure has been finished, I have been favoured with a fine specimen, by the Earl of Seaforth, which distinctly shows the form of the crystals to be similar to the last.

It is found (like most of the substances usually denominated Zeolite) lining and almost filling the hollows in a coarse kind of Trap, mixed with Carbonate of Lime, which fills the remainder of the hollows, and is peculiar for having striæ upon the long diagonals of the primitive or fractured faces.

The specimen figured came from Hall Hill, Kincardineshire.

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TAB. CCLXI.

Talcose Breccia.

Class 2. Earths. *Order* 2. Aggregate.

Having, through the interest of my kind friend Dr. Penneck of Penzance, received from Mr. Joshua Carne fine specimens of the Grey Slate Pebbles, spoken of by him to our mutual friend Davies Giddy, Esq. M. P., I thought it doubly incumbent on me to give a figure of it; first from respect to the donors, and next on account of its curiosity when examined in a geological point of view. I cannot describe it more satisfactorily than partly in Mr. Carne's own words *. It is observed that "The Relistian mine is nearly on a level with the surrounding country—the lode has been seen at the depth of 12, 25, 50, 65, 75, 81, and 90 fathoms from the surface. It is of different widths at different parts; the extreme width is 36 feet, and in this part it is principally worked. As it extends east and west, which is its due course, its width gradually diminishes, till at the distance of 100 fathoms east it is but 5 feet wide. It is composed, excepting the metallic part, of Schist †, Chlorite (in a distinct form), and Quartz. In some parts the Schist predominates, and in others the Chlorite; the Quartz is throughout the smallest component part. The engine shaft is situated 8 fathoms north of the widest part of the lode. In sinking the shaft, a flookan

* Phil. Trans. 1807. Part ii. p. 293.

† Consisting chiefly of greyish green Talc or Chlorite.

about two inches wide was discovered, bearing a south-east course, which cuts the lode at an angle of about 45°, and heaved and disordered it.

"At the depth of 12, 25, and 50 fathoms, nothing was discovered in the lode but the cavities from which the ore was taken away during the former period of working the mine. At 60 fathoms in depth were found, close to the flookan, a great number of angular fragments of Schist cemented by the same substance. At the depth of 75 fathoms the flookan became 4 inches wide in the shaft, and continued of that size for 10 fathoms; it then became divided into four parts or branches, each diverging from its former course, and in this state it continued through the lode, of which the first three feet were composed of Copper Pyrites, and then was discovered a body of Pebbles nearly twelve feet square, extending in width to the extreme branches of the flookan. In this part of the lode the Schist greatly predominates; of course the pebbles are generally composed of Schist, cemented in some parts by the same substance or Chlorite, in others by Oxide of Tin, which is generally crystallized; and in some of the crevices there is a little Copper Pyrites. It is singular, that a few pebbles, perhaps not more than half a score, were found of quite a different nature from the others; they were composed of Tin in Quartz coated with Chlorite. The pebbles did not continue in a body to the height of more than two fathoms; but scattered bunches and single pebbles were found four fathoms above, and six fathoms below the place in which they were first discovered.

"It is only necessary to add, that the lode has since been worked fifteen fathoms deeper than where the pebbles occurred; it there consists for the most part of Chlorite, in a regular manner; not the least trace of pebbles is to be seen, nor indeed of any disturbance in the strata."

Merely rounded pebbles of Slate would, to a common observer, appear extraordinary. Here we see the particular

decomposition of a primitive rock where it was least expected; and the Oxide of Tin, which, in most cases, seems coeval with the common Chlorite, Slate Rock, or Killas of the Cornish miners, seems again crystallized, if I may use the expression; and these new crystals generally differ from the former, and are truly curious as to the variety of their modifications, being excellent practice for a crystallographer. The Chlorite which serves to cement the pebbles, as before observed, is crystallized; and I find it, like *tab.* 182 of this work, in six-sided plates. Among the partly crystallized Quartz in my specimen, are some rather shattered interrupted fragments of white Fluor*. The Sulphuret of Copper, or Copper Pyrites, is rather in amorphous fragments, and there are some very brilliant crystals of Arsenical Iron, or Mispickel, a few of which are beautifully iridescent.

Besides the specimens which I have received from Dr. Penneck and Mr. Carne, I have been favoured with one by Dr. Turton, showing the Sulphuret of Copper.

* This has so much the appearance of shattered Quartz at first sight, that I imagine it might be all taken for Quartz. It burns beautifully phosphorescent; which is rather curious for white Fluor.

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Apr. 1. 1808. Publish'd by Ja.s Sowerby, London.

TAB. CCLXII.

FERRUM subsulphureum.

Subsulphuret of Iron, or Magnetical Pyrites.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* Subsulphuret.

SYN. Magnetical Pyrites. *Hatchett in Phil. Trans. for* 1804.

THE Rev. H. Davies of Beaumaris favoured me with these specimens from the foot of the mountain Moël Ælia in Caernarvonshire, from whence some specimens were sent by the Hon. Colonel Robert Greville to his brother the Hon. Charles Greville, about the year 1798, as mentioned by Charles Hatchett, Esq., who has published so able an account of it, with the analysis, in the Philosophical Transactions for 1804, and from which I subjoin a part of the description, with a reference to the more perfect one.

Mr. Hatchett observes that this Pyrites has been hitherto found only in some parts of Norway, Silesia, Bavaria, and at Mebendorf and Brichenbrun in Saxony. He found the British specimens to be magnetical, agreeing with others in every particular. A piece, nearly two inches square, acted upon the needle at a distance of four inches. The powder, which is blackish grey with but little metallic lustre, is immediately taken up by a common magnet, but the Pyrites does not act thus upon the powder, nor on iron filings, unless it has been placed for some time between magnetical bars: then indeed it acts powerfully, turns the needle completely round, attracts and takes up iron filings, and seems permanently to retain this addition to its original power. In the specimens which he obtained, the north pole was the strongest.

From the appearance of those parts of the Magnetical Pyrites which have been exposed to the weather, it seems to be liable to oxygenizement, but not to vitriolization.

By analysis, Mr. Hatchett found it to contain

Sulphur . . .	36·50
Metallic Iron .	63·50
	100·00

At a temperature of 63° the *Spec. Grav.* was 4318. It has been found to agree precisely with artificial Sulphuret of Iron, and it is fairly concluded that its proportions are probably subjected to certain laws, especially during its formation in the humid way, always acting in an invariable manner: and it is also found that Iron, when naturally or artificially combined with 36·50 or 37 per cent. of Sulphur, is not only still capable of receiving the magnetic fluid, but is also rendered capable of retaining it, and that beyond 45·30 or 46 per cent. of Sulphur, as in common Pyrites, all susceptibility of the magnetic influence seems to be destroyed. This and other proofs of certain proportions of mixtures having a peculiar effect upon the magnetic property of Iron, stamp a great value upon these researches.

I have a specimen showing the oxygenizement by moisture on the surface, having taken the impressions of the grass near which it lay; and I find that a fresh fracture is of a yellowish grey, but soon tarnishes.

The upper figure represents part of a stratified piece, which shows the fresh fracture with a surface that has an aggregated appearance; but this does not arise from any mixture.

The lower specimen, having a smoother fracture, shows it better, and has a tendency towards a cubic crystallization, which would seem to mark its relationship to common Pyrites, although they are nevertheless sufficiently distinct.

The upper specimen, figured at *tab.* 30, is nearly of the sort of Pyrites spoken of by Mr. Hatchett as accompanying this magnetical kind. It is also accompanied by Lapis Ollaris or Potstone, though not of the best sort. I find Yellow Copper Ore and Sulphuret of Lead attached to some of my specimens.

I have some of the magnetic part of the rock from Wicklow in Ireland, which has a distant resemblance to Magnetic Pyrites, but is duller, greyish or blackish, and does not in common fly to the magnet so readily.

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April 1, 1808, Published by Jas. Sowerby, London.

TAB. CCLXIII.

FERRUM suboxygenizatum.
Magnetic Iron in Quartz.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 2. Suboxide.
Div. 1. Crystallized.

In the year 1796 I found in a gravel walk in Kensington Gardens a rather large pebble, holding magnetic Iron; but not thinking much of it at that time, I only put it out of the public path: and after a few years had elapsed, recollecting it might be a curiosity, I searched it out, and now find it to be an unique, at least as British, especially as the Iron is in veins, and in very neat, though minute, octaëdrons. As it leads to some other varieties, I introduce it here with another undescribed as British, which was the case with those figured before at *tab.* 54.

The lower figure is from the Isle of Wight. The specimen was sent me by Charles Lyell, Esq. It is grey with a crimson hue, sandy, but replete with magnetical Iron resembling the finest dust, and very attractable.

Apr. 1 1808 Publish'd by Jas. Sowerby, London.

TAB. CCLXIV.

FERRUM oxygenizatum.

Oxide of Iron.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 3. Oxide.
Div. 3. Amorphous.

In the Isle of Wight, and many other places, there are masses of irony sand, varying in size and thickness; sometimes forming partly in strata, and often in curving pieces, which have been parts of large rounded masses, coating each other more or less regularly, containing much Iron, being very heavy. They are but just so much oxygenized as not to be attractable by the magnet. I have seen much of the same substance near Bletchingley, Surry. I thought to have finished this subject, and not to have given figures here; but having said thus much, it might seem wrong to leave out any thing worth mentioning. I therefore add this plate for two varieties of these, that less might be wanted towards the completion of a work intended to contain all possible intelligence as to mineral substances, especially as the specimens are remarkable, and have not, to my knowledge, been noticed elsewhere.

The upper figure is a piece from Alum Bay in the Isle of Wight; it is of a moderate size, for those near Bletchingley were very large.

The lower figure is nearly of the same nature, and was sent me from near Dufton. It serves to show how widely the substance is spread, and that it has been considered by others at least as somewhat curious.

June 1.1806. Publish'd by Jas. Sowerby London.

TAB. CCLXV.

SILEX Mesotypus.
Mesotype.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. Silex. *Spec.*
Div. 1. Crystallized.

SYN. Zeolithes figurâ determinatâ crystallizatus. *Waller*. 1. 328.
Zeolithes. *Cronst*. 108—112.
Zéolithe en aiguilles prismatiques ou pyramidales. *De Lisle*, 2. 41.
Argile unie à la terre silicieuse, faisant la moitié du poids, et quelquefois davantage, et à un peu de chaux. Zéolithe. *Sciagr*. 1. 301.
Zeolith. *Emmerl*. 1. 199. *Wern*. 1. 265.
Zeolite. *Kirw*. 1. 278.
La Zéolithe. *Brochant*, 1. 298.
Mesotype. *Haüy*, 3. 151.

PERHAPS it is one of the most curious phænomena in Nature, that in the craggy Trap Rocks which include so many substances, most of them seem to be passing into new appearances, as if having been of different composition or differently acted upon by confined agents continually working. Thus Quartz, Chalcedony, Hyalite, Analcime, Chabasie, and the present substance, with some others, sometimes fill a number of spaces, or line them, or are crystallized in various ways. In this instance the crystals are uncommonly interesting, being so like one distinct substance passing out of another, that it has been compared to crystals passing out of shells, the cavity they pass from being often coated with a substance outwardly resembling a pebble fitting the unequal hollow, and itself hollowed by decom-

position, and forming these beautiful appearances. Being from Dalton in Lancashire, where it certainly could not have been expected, makes this specimen still more curious; for this substance was thought rare even in Scotland, and has but lately been discovered any where, as will be seen in the next table.

The specimens I possess pass from transparent or opaque white to reddish or topaz-like yellow. They are contained in hollow stone cases, lined as it were by Analcime. —See *tab.* 59, and *the lower left hand magnified figure* of this plate. The crystals of Mesotype, which are peculiarly neat right-angled four-sided prisms terminated by obtuse four-sided pyramids, are sometimes a little varied as to the number of their angles: for when any faces of a regular crystal are, as it were, deeper cut, they borrow angles from their neighbours; thus the otherwise regular three-angled plane of the four-sided pyramid, trespassing occasionally on the column and opposite faces, becomes six-sided; which will be easily understood by the figure.

This substance differs from Stilbite and other substances which have been called Zeolites, not only in the form of the crystal, but in the fracture, and in being electric by heat. It is so far soluble in nitric acid as to form a jelly, which other similar minerals are not. Zeolites in general may be known by their being capable of a particular kind of ebullition, forming a frothy enamel under the action of the blowpipe.

I figure some from Raghlin in Scotland, and have some specimens nearly similar, but not so fine, from Antrim, found among Basalt, and some from the county of Derry, by favour of my kind friends Dr. Scott, John Templeton, Esq., and Mr. Tennant.

I suppose, now it is made known, it will be recognised in many places in Great Britain. It is, however, still to be remarked, that our authors are more generally backward to acknowledge British specimens than foreign ones.

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June 1. 1806. Published by Jas. Sowerby London.

TAB. CCLXVI.

THE *upper fine specimen* from Raghlin in Scotland is preserved in the collection of G. B. Greenough, Esq., and is so beautiful as almost to surpass representation. The crystals are thinner and smaller than mine, but longer and very numerous, and their numbers give an idea of their being merely spiculæ; but being magnified they may be seen to have the same formation as in the larger ones.

The lower specimen came from Cave Hill near Belfast, and, like one of Mr. Greenough's, has almost all the ends broken away; which perhaps often happens, as I have seen many so, by their running in opposite directions against each other, which they frequently do; and in this and other instances the circumstance becomes interesting, as the inside reflects a transparent shadow owing to a small opacity on the outside, which seems natural to it, and on viewing the ends, gives them a rather singular and new appearance, somewhat resembling Chiastolite.—See *tab.* 116, *right hand geometrical figure.*

Is not the Nadelstein, Needle-stone, Needle-zeolite of Werner, the same with this substance? It is found in Iceland and Lower Brittany.

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Published May 1.1808 by Jas. Sowerby London.

TAB. CCLXVII.

CARBO ferriferum.
Plumbago. Black Lead.

Class 1. Combustibles. *Order* 1. Homogeneous.
Gen. 6. Carbon.

SYN. Graphites plumbago. *Linn. ed.* 13. 3. 284.
Plombagine. *De Lisle*, 2. 500.
———— Carbure de fer. *De Born*, 2. 395.
Phlogistique saturé de l'acide aérien. Plombagine, *Sciagr.* 2. 8.
Graphit. *Emmerl.* 2. 97.
Fer minéralisé par le Carbon. *Daubenton*, 49.
Carbon combined with one tenth or one eighth of its weight of Metallic Iron. *Kirw.* 2. 58.

THIS curious substance, so extensively used by artists of all descriptions, is nowhere found in greater perfection than at Borrodale near Keswick in Cumberland. It is also found at Crumnock in Ayrshire, and at Kilkenny Well in Ireland, besides some other parts of Europe. That from Borrodale is made into the finest Black Lead pencils of any in the world, and there is a regular sale of it once a month in London for that purpose. Jameson says that the finer kinds are first boiled in oil, and then cut into tables or pencils. He is surely mistaken; and I think a proper examination of the substance in the best pencils is enough to prove it*.

The Plumbago is sold under the title of Black Lead: and the larger lumps, above six inches in length, are bought at 40*s*. per pound—the middling, from about four inches long, for 35*s*. per pound: and smaller, about the size of walnuts, are called pints, and sell at 25*s*. per pound. The buyers or their agents attend and try its goodness by scraping it, always rejecting it when sandy, spongy or powdery; and it is curious to observe the singular shining appearance the examiners make. Sir Joseph Banks generally has a few pencils of the best kind made for himself and a friend, and no art is used to alter the genuine nature of the best Lead. It is, however, said, that there is an art known to one or two pencil-makers, by

* We have boiled various fragments in oil, and find them in no way changed:—a red heat softens Plumbago considerably, at the same time it loses 6 or 7 per cent. of its weight.

which they manage the Lead so as to make it as hard as they like. I believe it is pretty well known that the Chalks used in drawing are tempered by the changes from damp to dry, which have a similar effect on Plumbago. It is certainly most generally used without any alteration, and those are most certain of making the best pencils, who have the cunning to choose the most perfect substance. The harder and finer Lead is generally sawn out smallest for the best price, and the coarser sawn out larger for commoner purposes, and is cheaper, exclusive of the mixtures made from the dust with Sulphur, Rosin, &c. which are scarcely worth mentioning. This and the more common sort of Lead in dust from various places are used for cleaning stoves *, and for making crucibles, which will bear a strong heat.

Plumbago is mostly found included in mixed rocks—see *the next table*—in pieces from a grain to 40 or 50 pounds in weight, or larger; there is a piece in the London warehouse of 42 pounds and a half weight, consequently worth 85*l.*

It has a dull dusty or granular outside, but the least rub or scratch exposes its bright gray metallic lustre. Its fracture is mostly rough and fine, or coarse grained, sometimes rather plated and even foliated. It feels greasy, as it has generally been called, but I submit the word 'slippery' to the judgement of the critics. It is, on this account, often used as a preventative to the effects of friction, in preference to soap. It soils, neatly if required, but does not clog. I could never discover it at all crystallized.

The upper figure is from a pure chosen specimen, with which I was favoured by the proprietor of the mine, the Right Hon. Sir Joseph Banks, Bart.; and an honest pencil-maker, who has attended the sale and seen large quantities for many years, assured me it was of the very best sort. The shape is as cut out for sale, and the colour is perfect, being composed of the substance itself, with the addition of gum water. The substance in question is too well known to need any more particular mention; it is, however, necessary to say that Molybdenum much resembles it, but is much brighter, and foliated like Mica. Its specific gravity is from 1·987 to 2·2456.

On analysis it has been found to contain :—

Carbon or Oxide? of Carbon	90·9	or	90
Iron	9·1	or	10
	100·0		100

* I understand this dust is occasionally adulterated with micaceous Iron—see *tab.* 64—which is apt to rust, to the great disappointment of the careful housewife, who considers it as the property of the Black-Lead to prevent the Iron from rusting.

June 1.1808. Publish'd by Jas Sowerby, London.

TAB. CCLXVIII.

Plumbago in the Rock.

THIS substance is found in the form of pebbles in rocks, making Pudding-Stones, Amygdaloids, and a sort of Traps, and seems to have been but little understood by mineralogical writers.

The rock is seldom schistose or slaty. It is sometimes veined with red Carbonate of Lime; sometimes it consists of a grayish or greenish compact steatitic or magnesian mixture, including the Plumbago, very intimately mixed, or in powdery-looking particles, minute pebbles, and other forms, some resembling fragments, in common with particles of yellow Pyrites, pebbles of Quartz, &c., tightly or loosely included *.

The upper figure represents an amorphous spotted mass with the Plumbago, Pyrites, and Quartz pebbles.

The lower figure has much the resemblance of common dark Limestone, and is much impregnated with Plumbago, a small mass of which lies on the surface.

I have a specimen of somewhat largely foliated Plumbago holding small cubic yellow Pyrites, varying from a bright colour to different states of decomposition, but not passing towards Plumbago. I have some Plumbago in a stratified piece of Quartz, coloured by red Oxide of Iron: indeed the rock it is found in varies much.

* Some substance, probably Quartz, runs occasionally among it, resembling Actynolite, being in longish striæ. My friend Mr. Sheffield, in his curious collection, has a piece of this, and I was favoured with a specimen by the kindness of Mr. Squire.

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TAB. CCLXIX.

Prismatic Plumbago.

For this fine specimen we are obliged to the favour of G. B. Greenough, Esq., M. P. P. G. S., who had it from near Crumnock in Ayrshire. The shape and approach towards crystallization, if it may be so called, somewhat accords with some of the columnar stones *, of which the late Mr. Watt has with much philosophy given a valuable paper in the *Philosophical Transactions for* 1804. The formation of Basalt differs much from this, in which we have to account for the transverse joints or articulations, which do not so plainly appear in this; although there are some indications of separation in some parts, yet I would rather compare it to the separation usual to crystals of coals.—See *Crystallography* and *British Mineralogy, tab.* 48. The same form nearly remains even in the cinder of the common coal, if slowly burnt; so this resemblance may depend upon similar laws, having the same original atom or nucleus, if I may so call it.

This extraordinary substance is as yet new in this form to the mineralogical world, nor do we know of it as any other than a British production.

The specimen before us shows the probable varieties of this formation, from straight to curved, and are somewhat varied in the angles and number of them, in which it much resembles various Coals when partly burnt in a slow fire,

* A peculiar stone found in columnar forms, reaching many miles, at the Giant's Causeway in Ireland and at many other places, of which more will be said hereafter.

which crack or divide into irregular columnar appearances, although larger and more expanded, somewhat agreeing also with the mineral coke—see *tab.* 192:—but as they are also more compact, it may depend upon the substances around them preventing in a great measure their expansion, which would agree in some measure with the experiments made by the ingenious Sir James Hall.

A long time since I received a portion of columnar Glance Coal from a Dyke about ten miles from Wanlock-Head, by favour of G. Laing, Esq., which so nearly resembles this in structure and appearance, that thence we might suppose them the same thing; and Mr. Greenough has specimens which are more intermediate, some parts having Plumbago about them.

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June 1.1808, Publish'd by Jas. Sowerby, London.

TAB. CCLXX.

PLUMBUM sulphatum.

Class 3. Metals. *Order* 1. Homogeneous.
Div. 3. Amorphous.

THIS curious, apparently new, decomposition of Galæna is so remarkable in its property of burning with a blue flame, like Sulphur, that it seems a prodigy, and has from that circumstance been called inflammable Lead Ore.

The upper figure shows some remains of the cubic forms of the Galæna, the outside having been so affected as to have blunted and in some parts obliterated the angles.

The lower specimen is more compact, and is striated with more or less zigzag lines, and has a few blotches of Galæna about it. The outside is generally whitish with a granular texture passing to crystallization. Inwardly it is generally somewhat darker and often of a dense gray, with a horny appearance and flinty fracture. It shines upon being slightly rubbed with the finger nail, and may be easily scraped.

As this substance is scarcely known, of course there is no analysis recorded. Having examined it by the blowpipe, we annex a short account of the changes it underwent. A piece being laid on Charcoal, and the flame gently applied by the blowpipe, it became red-hot, the Sulphur sublimed from the interior and melted with a greasy aspect, and a trifling blue flame, leaving the substance rather lighter in colour when cold. On further urging the flame, white Sulphate of Lead appeared on the surface which bubbled and blistered, and on cooling showed some signs of facets and spiculæ. After a while it was reduced to a globule of Lead. On further examination we find it to be composed of Sulphate of Lead, and about 10 per cent. of Sulphur.

June 1.1806 Published by Jas. Sowerby London

TAB. CCLXXI.

PLUMBUM sulphureum.

Sulphuret of Lead, or Galæna.

Div. 1. Crystallized.

The Galæna, or Sulphuret of Lead, is remarkably striking in this figure, not only because it is eight times repeated in stripes, but the coincidence of the opposite halves is peculiar; the outer stripes are nearly of the same width, and the next within them double, and those again nearer the middle are single, and nearly the same width, so that the whole together form eight lines in pairs. The substance in the middle of the specimen is Sulphate of Barytes, and the substance between the lines of Sulphuret of Lead is Carbonate of Lime; there is some Sulphate of Barytes on the outer sides.

The specimen came from Derbyshire. I know not in what position it was found, whether lying horizontally, perpendicularly, or obliquely: it, however, has been admired as a remarkable stratification by some, and as an example of a vein by others, instancing what Dr. Thomson says of a vein according to Werner, where it is understood as characteristic of a vein to have opposite sides alike, with the same or different substances often repeated. The lower pair of double stripes differ from the upper in this specimen, by having a more regular and equally bounded zigzag line between them.

The lower figure is Sulphate of Strontian from Bristol, bounded by Sulphuret of Lead.

We do not know that this has been before noticed, and it is very rare at present. The modification of the Strontian indicates a centre, and the crystallizations seem to meet in the middle somewhat in points; but whether this lined a cavity on the inside of a fissure or vein I know not, nor does it often happen that the workmen are very particular in this respect; but metals of some kinds may be said to indicate veins or lodes, which are nearly the same thing.

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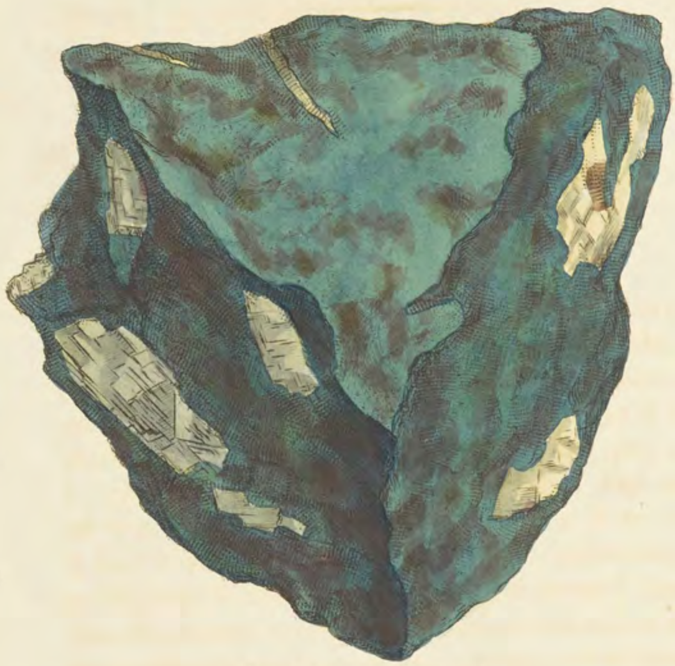

June 1.1808. Publish'd by Jas. Sowerby London.

TAB. CCLXXII.

SILEX talcum.

Earthy Talc. Green Earth of Veraw.
Terre verte.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. Silex. *Spec.* Talcum.
Div. 3. Amorphous.

Syn. Green Earth. *Kirw.* 1. 196.

SAID to be found near Verona, as well as in Bohemia, &c. also in Scotland, and Somersetshire. The present specimen came from the Hill of Kinnoul in Scotland. It is the largest piece I have ever seen, and was lent me by G. B. Greenough, Esq. It is to be found entrapped in a smoothish earthy rock in various forms and of different sizes. I know not if it could be gathered so pure as to serve for commerce there or any where else in Great Britain; but if it could, I should think it might be chosen of such tints as might be desirable to artists, it being very durable. It may probably be the pigment used in the large draperies often exhibited in pictures of the Venetian school, so much admired by connoisseurs for their brilliant and lasting greens. Mr. Kirwan thought the green colour was owing to a mixture of "Calx of Nickel." It is not, however, known at present what gives permanent colour to most mineral substances. Iron in this seems to be particularly oxidated, so as to serve that purpose, perhaps with the help of a peculiar phosphate of a blue colour, mixed with a certain

yellow Oxide, or Sulphur, these being so nicely incorporated in the mass as not to be easily detected. Most endeavours to ascertain the colours of substances first discolour them, and it is not easy to find and mix the proportions by synthesis, although the present advancing state of chemical knowledge gives a hope that these things are likely to be discovered in due time.

The analysis by Klaproth shows no particular colouring substance except Iron, as will be seen below:

Silica	53
Alumina . . .	12
Magnesia . . .	3·5
Lime	2·5
Oxide of Iron . .	17
Water	11
Loss	1
	100·0

The holes in the Rock of Kinnoul are occasionally lined or filled with great variety of coloured substances, perhaps including all possible mixtures, except the more brilliant reds and crimsons.

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TAB. CCLXXIII.

BITUMEN succinum.

Amber.

Class 1. Combustibles. *Order* 2. Compound.
Div. 1. Amorphous.

Spec. Char. Bitumen in combination with Succinic Acid.

Syn. Succinum electricum. Bernsten. *Linn. ed.* 13. *t.* 3. *p.* 108.
Succinum durius, Europæum; Succinum. *Waller.* 2. 108.
Karabe, Carabe, Succinum, Electrum, Glessum; Ambra citrina, Sacal. *Lemery Diction.* 463.
Succin. *De Lisle*, 2. 589.
Succin, Ambre jaune; Karabé. *De Born.* 2. 88.
Bernstein. *Emmerl.* 2. 81.
Petrole combiné avec l'Huile de Succin. *Sciagr.* 2. 22.
Ambre jaune. *Daub.* 30.
Amber. *Kirw.* 2. 65.
Succin. *Haüy*, 3. 327.

Perhaps, for an anciently-known substance, Amber is as little understood as many more modern substances. Some consider it as a mineral oil with oxygen, or, as Mr. Parkinson, an inspissated mineral oil. By others it has been thought either honey or wax indurated, though mostly judged to be an indurated vegetable gum or resin; and Mr. Patrin, among his arguments for its being honey,

supposes gums or resins could not entrap insects, which Amber is often understood to do, and even fishes.

The resin called Gum Anime by the apothecaries and varnish-makers, is often used to make varnish, which very nearly resembles amber varnish, as the resin itself does Amber. Pieces of this frequently contain many ants and other insects, as well as the Gum Copal. I have seen a fish enclosed in Amber, bought at the high price of five guineas *, and have heard of another at the same price, which, when examined, was found to have had the fish enclosed betwixt two concave pieces; the said fish being a badly dried stickleback, a very common inhabitant of our own pools and ditches. It is very seldom, if ever, we see perfect Amber with insects, as it either has a deceptive appearance, or what was supposed to be Amber proves either Copal or Gum Anime.

I find by my specimens of true Amber that it is subject to much variation, even in that character which has been deemed its principal criterion, viz. its odour, as some of the amber-workers, who seem to know it pretty well, find it occasionally very disagreeable. This causes much contradiction among collectors.

The best characters I can find for Amber at present are, that it occurs in irregularly rounded forms with a roughish coat, rendered dull with small semicircular flaws, varying from very bright transparent yellowish red to opaque white. When broken it has a waxy, or resinous, and rather horny appearance; mostly having a conchoidal surface, and often sharp edges. It is resinously electric †, and, on being briskly rubbed, gives out sparks visible in the dark. It takes a good polish easily, and retains it better than most resins, with a far superior degree of richness. It is rather colder, and I can fancy it allows the finger to slide more readily over it; it is also rather tougher than the hardest resin.

* Not a high price, if no deception.

† All the resinous substances are nearly alike electric by rubbing, which is often considered as a characteristic mark of Amber.

The acid obtained from Amber, called Succinic, is peculiar to it, the origin of this name being obvious.

Amber is said by Woodward to be found in the clayey or aluminous rock, and on the shore, at Whitby, in three states or varieties. He names the three varieties, Rock, Washed, and Fat Amber. It is found in many of the northern parts of Europe as well as in Great Britain, in which it occurs on the Norfolk and Suffolk coasts, chiefly at Lowestoft, sometimes in great variety. Some authors speak of two varieties, white and yellow, but the white is generally described as of a light or straw yellow.

Some parts of *the upper figure* are so perfectly white that it will not allow of any other denomination: it is opaque, and forms a great contrast to the yellow or redder parts, which are transparent.

The lower figure is taken from a specimen with which I was favoured by Dr. J. E. Smith. It is such as is commonly called Fat Amber, and does not unaptly resemble some sorts of fat, having a mixt and clouded appearance. Some pieces more nearly resemble Mineral Tallow, such as is found in Ireland, by some considered as butter preserved in the bogs of that country.

I have specimens of this, and mention it here, as sufficient, not at present considering it as a truly mineralogical substance, although mentioned by the excellent Kirwan. It is certainly the spermaceti-like remains of some animal. I have also the kernel of a common nut of a whitish fat or greasy appearance, exactly resembling the Mineral Tallow. It was found in the Thames with its shell entire.

Amber is much esteemed when large, and free from flaws, specks or blotches, either for curiosity or for ornamental purposes, and sells for a proportionate price. It is supposed to have preceded the use of ornamental jewels; which seems very natural, as the ruder people would manage it better than hard stones. Accordingly we find in the tumuli * of

* These, according to the observations of my friend, the experienced Mr. Cunnington, are the most antient Tumuli; and although they some-

the primitive Britons that they made their beads and other ornaments chiefly of Amber or of Jet, with a few rude glass beads, and some ivory; but we do not know that any gems have been noticed among them.

times have ivory, gold and copper, these articles seem distinctly to have belonged to a more polished people by the neatness of their workmanship, and were possibly taken in barter from the Gauls or Phœnicians. The Amber they made use of is mostly of a dark and very red colour, perhaps from having been long immured in such a situation, being also much cracked, like Amber that has been long exposed. Plates of two inches long by one inch and a half wide have been sometimes found. Amber is sent to the East Indies by the merchants, where it is much valued for its beauty, and its supposed qualities as a charm.

[illegible] by Jas. Sowerby London.

TAB. CCLXXIV.

Although much has been said about insects, leaves, bits of plants, gold, silver, and iron * being found in Amber, I do not know of Pyrites having being positively noticed. I have some with Pyrites in it in small globules, and one specimen with the decomposed remains of wire-like Pyrites in long diverging tubes. The latter I figure while there yet remains this vestige of the Pyrites. It was observed when in the dealer's hands; but as he did not know how to value it, although I told him the Pyrites was decomposing, I did not obtain it until it was nearly decomposed, notwithstanding its being of no value but as a specimen, from its foul and unbrilliant aspect.

The upper figure shows a piece with the striæ or tubes more or less filled with Sulphur and decomposing Pyrites.

The lower figure exhibits another piece with small knobs or little round specks of Pyrites, some decomposing and showing the Sulphur and empty holes.

The left hand figure much resembles Gum Anime in the common outward aspect, except that it appears to take a more perfect polish. It, however, has all the characters of Amber, and encloses about the middle an insect of the Hymenopterous Class, probably of the Genus *Sphex;* but it seems a species not known at present. I prize this more than ordinary, as I have good reason to suppose it came from the Lowestoft coast. It contains also some drops of liquid, which I suppose have not been before observed in Amber—See *the lower corner towards the right hand.*

The specimen is full of flaws and cracks, and holds

* In the Encyclopædia Britannica it is questioned whether this gold or silver may not be Marcasite, and the Iron is mentioned as being sometimes in the state of Vitriol. The glistening appearance of the flaws may often mislead.

much of a dirty-looking substance, rather of a carbonaceous appearance.

I have not seen British Amber so large, and free from what is commonly called foul, or cracks, as the foreign; but the present specimens pretty well include all the usual colours of Amber. All the fine and clear specimens that fall into the hands of the dealers are sure to be deprived of their coat, as this has been, or to be cut into some fanciful form so as to make them more saleable.

Amber is sometimes of considerable size. I have seen a fragment measuring fourteen inches and a half in girth lengthwise, by seven inches and a half in girth the shortest way. It weighed nine ounces and a quarter. It is however said that there was in the possession of the Grand Duke of Tuscany a column of Amber of ten feet in height. It is said to have been well known to the Arabians, who called it Ambra, and to the Greeks, who called it Ἤλεκτρον*.

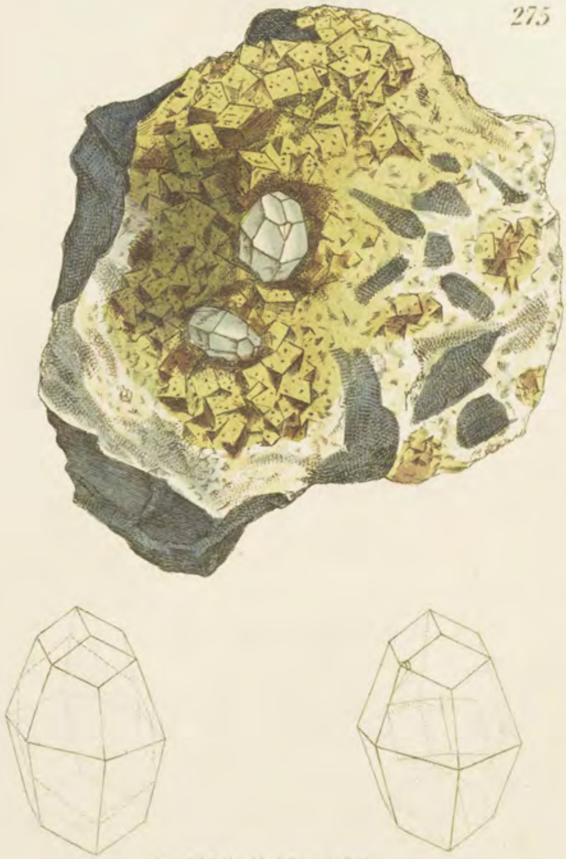
* Some may be led to suppose from reading in Ezekiel i. 4, and 27, and viii. 2, "as the colour of Amber," that this substance was known to the Hebrews in the time of the Prophet; but on further investigation it will appear hardly safe to found such an opinion upon the received English Version. Junius and Tremellius render the passage "*tanquam color vividissimus*:" and Dr. John Taylor in his Hebrew Concordance has חשמל, which occurs only in the above-cited three passages, *pruna ignita*. The LXX have ὡς ὅρασις ἠλέκτρου, and the Vulgate "*quasi species electri*;" but ἤλεκτρον, *electrum*, here doubtless signifies, as it often does, an alloy of gold and silver, and not Amber. And the account given in the Synopsis Criticorum of the word חשמל, chasmal, is probably right. It is supposed that Ezekiel borrowed the word from the Chaldee, in which dialect it signified a brilliant alloy, mixed not of gold and silver, but of gold and brass, being the χαλκοχρύσιον, or χαλκὸς χρυσοειδὴς of Diodorus, and thât it is composed of the Chaldee words נחש, nachas, *brass* (the נ being dropt as in other analogous instances), and מלל, מללא, malal, *gold*. Some commentators, desirous of extracting all the meaning they can out of a word, have maintained that the Prophet selected this substance, as expressive of the union of the divine and human nature in Christ.

Amber having been first found on the shores of the Baltic, Skinner is of opinion that the Arabs were indebted for their name *Ambra* or *Anbar*, as well as for the substance itself, to the Teutonic nations. In Dutch Aen-bern is *to burn up*, and Aen-bern-steen, lapis ustilis, *the combustible stone*, Bern-steen is still its name in Holland. It appears from Tacitus (De Mor. Germ.) that the ancient Germans called it Glæs, which is probably the same word with our Glass.

Plato and Aristotle recommended it for many virtues, and Thales observed that it attracted light bodies, 600 years before the Christian æra. It was in high esteem as a luxury among the Romans.

Since writing the above, I have been favoured by Lord Dundas with references to those best informed respecting the coast and rocks at Whitby, especially the Rev. Joseph Harrison, who gives us every reason to believe that Amber is seldom or never found on the shores or cliffs near Whitby, although they produce the substance usually found near it, viz. Jet, which has been known there for many years. Indeed it would appear that Dr. Woodward was imposed upon.

It is not a little curious that the Fat or Opaque Amber may often be made transparent by being boiled in olive oil; but in most instances it thereby acquires flaws that have been compared to fishes' scales entrapped in the same manner as insects.



TAB. CCLXXV.

C A L X carbonata.
Carbonate of Lime.

Div. 1. Crystallized.

The perhaps numberless variations in the forms of the crystals of Carbonate of Lime, however difficult they may at first be considered by many, are one of the surest proofs of the necessity of attending particularly to their formation; for when we are a little conversant with them, they seldom fail to indicate the place to which a specimen should be referred.

The present variety is formed of two regular hexaëdral pyramids applied base to base, each terminated by the faces of the equiaxe rhomb—see *tab.* 34—the alternate solid angles near the summit, being bevelled, form the little that remains of the metastatic variety—see *tab.* 33. The incidence of the three edges of the termination on the corresponding edges of the pyramid is about 122°, that of the face of termination on the other three is nearly 133°, and the two pyramids on each other about 145°. The crystals are apt to vary a little, especially those in the next plate, for which these measures will serve.

The right hand geometrical figure in this plate shows the position of the primitive rhomb in the centre, and *the left hand one* shows the oblique base of the curious mackle that belongs to this modification, to assist in the explanation of the next plate.

The crystals are extremely neat on this specimen, which is in the possession of Mr. Lowry, whose remarkable abilities are so well known. It came from Ecton-mine, in Staffordshire. The same gentleman has a group of crystals of the same form from nearly the same spot; one crystal about ten inches in circumference, and nearly as long.

The present specimen is rendered handsome, and serves two purposes here, by giving an example of yellow fluor. There are also some varieties of octaëdral Pyrites, a few little spots of Galæna, &c. The whole stand on a piece of shattered schistose Limestone.

TAB. CCLXXVI.

Carbonate of Lime.

THIS singular modification of Carbonate of Lime came from the neighbourhood of the Ecton-mine, Staffordshire, having been gathered by W. E. Sheffield, Esq., who was so good as to favour me with the use of the specimen. The depth of two of the facets of each pyramid, or the want of a proper supply to give them a proportion to the others, is a sort of deception, as they are nearly the same with the foregoing, except one or two additional facets, and the diagonal mackling. Thus the whole is shortly accounted for; and as these are extremely rare specimens, I was glad of an opportunity to show them, and to explain so instructive a lesson in Crystallography.

The gangue is chiefly of variegated Pyrites, but in another specimen possessed by my friend there is much Sulphate of Barytes with the faces as in *the geometrical figure at the bottom of tab.* 72, giving them a singular sharp-edged appearance; and the modifications of the Carbonate of Lime are rather more mixed, or have the other ends of the crystals appearing in some parts beyond the mackling, rather irregularly. I am the more gratified in having the use of these specimens, as the mackle in such a direction in Carbonate of Lime has not, to my knowledge, been noticed before, nor is it mentioned by Haüy, being in itself very puzzling.

The place of intersection is parallel to one of the faces of the equiaxe rhomb, or to the edge of the nucleus, and corresponds with the diagonal fractures that may be obtained from some varieties of Carbonate of Lime.

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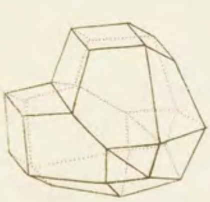

Aug. 1. 1808. Publish'd by Jas. Sowerby London.

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TAB. CCLXXVII.

TITANIUM oxygenizatum, *var.* ferriferum.
Menachanite. Ferriferous Oxide of Titanium.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 20. Titanium. *Spec.* 1. Oxygenizatum.
Var. Ferriferous.

SYN. Menachanite. *Kirw.* 2. 326. *Gregor.*
Nigrine. *Karsten*, 56.
Titane oxidé ferrifére. *Haüy*, 4. 305.

WE are indebted for the first discovery of this curious substance to the penetration of our ingenious friend the Rev. Mr. Gregor, who examined it in the year 1781, and discovered that besides Iron, it contained a new metal, which he called Menachine, but which appears to have been the same with what has since been discovered in the Red Schoerl by Klaproth, and is named Titanium. This name has obtained most general use, on account of the great authority of the chemist by whom it was given, although Menachine might with much propriety have been preferred, as being originally given to the substance by Mr. Gregor; he being undoubtedly the first who named it, as well as the first discoverer of it. The term Menachanite has been applied to the substance here figured from the name of the place where it was first found, the valley of Menachan, in Cornwall. The same substance is said to have been since met with in the Island of Providence and in New Holland. It bears some resemblance to gunpowder, but has rather more the appearance of grains of Plumbago. The grains do not assume any particular shape, some being

flattish and angular, and others finely granulated. Menachanite is easily pulverized, is rather brittle, and slightly attractable by the magnet. Its surface is opaque, somewhat shining, grayish black, retaining its colour when pounded, in which it differs from the Iron Sand of *tab.* 197.

By analysis, Mr. Gregor found it to contain

Oxide of Titanium . .	45
Oxide of Iron . . .	46
Loss	9
	100

Among the loss a little Silica and Oxide of Manganese are included. A trifle of Oxide of Manganese, Silica, and Alumina have been found since in some specimens by other persons; but as these may be reckoned rather adventitious, Mr. Gregor's seems most to be depended upon. Klaproth, Hecht, and Vauquelin have clearly proved Mr. Gregor's accuracy by their analyses.

Spec. Grav. 4·427.

The Oxide of Titanium, when separate from the other ingredients of the Menachanite, has these peculiar properties. It may be reduced by exposing it with charcoal to a violent heat, when it assumes a deep copper colour, with much lustre and brittleness, but is elastic when in thin plates. It is extremely difficult of fusion. It is easily tarnished by air, or oxidized by heat, becoming blue, and detonates when thrown on hot Nitre. It is said to form three Oxides, viz. the blue or purple, the red, and the white.

We, as well as Haüy, consider the Nigrine of Karsten as a variety of Menachanite, but generally much freer from Iron.

Aug. 1. 1808. Publish'd by Jas. Sowerby, London.

TAB. CCLXXVIII.

PLUMBUM oxygenizatum.

Minium, or Red Oxide of Lead.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 15. Plumbum. *Spec.* 1. Oxygenizatum.
Div. 1. Amorphous.

THIS new and truly curious production is unusually interesting, as being found naturally formed, and will probably afford a lesson for the chemist, as the work of the great Laboratory of Nature: especially as it exposes a subject usually formed by a sort of volcanic process, if I may so term it, and which yet has here every appearance of a Neptunian origin. Possibly the very process of thus procuring it may be of consequence enough to teach us how to preserve its most inimitable tint, which has hitherto been a great desideratum. It should seem by the nature of the specimen that something has wrought a sort of furrow or concave passage through the Galæna, and that this was a very powerful menstruum, penetrating it so deeply in some parts, and in such a manner, as to give the appearance of worm-holes; these holes are lined with the Oxide of Lead of the usual scarlet colour, in a fine-grained powder, about the thickness of paper, adhering to the Galæna rather closely, and which, when separated, shows a dull roughish site with a corroded appearance. Upon the surface of the Minium we may almost recognise a substance between Massicot and Litharge, about the same thickness, separating in irregular patches, in extremely fine particles, which, with a magnifying glass, seem to sparkle, and have something of a scaly appearance. In some parts they

are of a lighter yellow and nearly white, as the colouring of the figure indicates.

In a letter to Sir Joseph Banks, from Smithson Tennant, Esq., it will be found that he has lately discovered this substance abroad*.

* See Phil. Trans. for 1806, and Phil. Mag. xxvi. 114.

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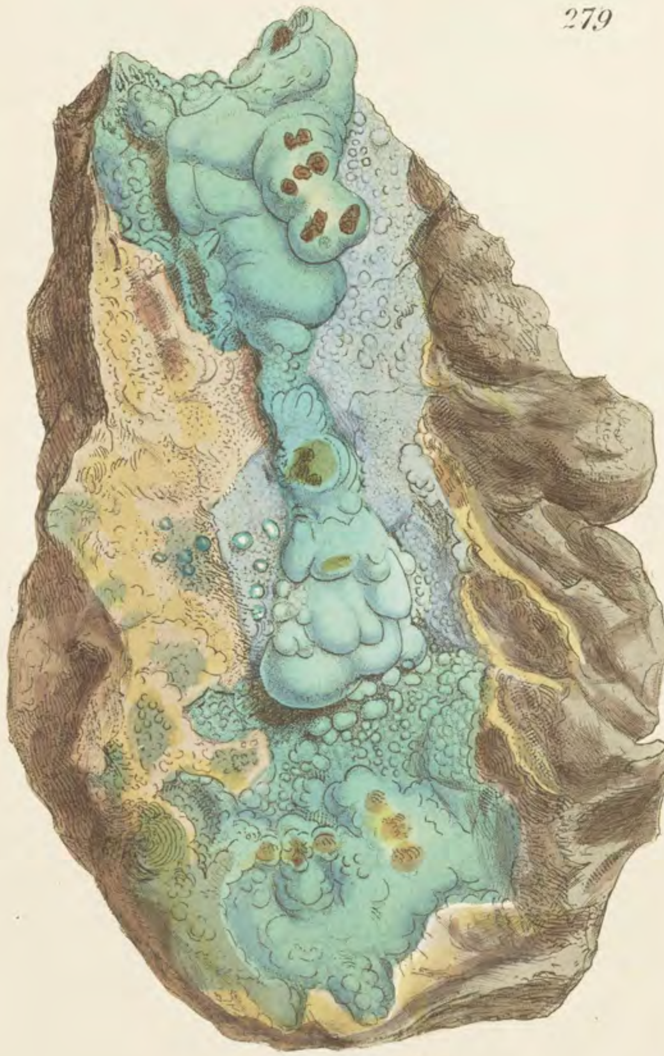

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TAB. CCLXXIX.

CUPRUM hyperoxygenizatum.
Peroxide or rather Hydrate of Copper.

THE specimen here figured was brought from Dalehead-mine, in Cumberland, and is in the possession of W.E. Sheffield, Esq., who, with the utmost generosity, has offered to lend his best specimens for this public use. I have only seen one exactly corresponding with this as to its waxy appearance. In the drops, and general form, they well agree, as they do also in fracture; so that it might be called a specific distinction. I was favoured with this latter by Mr. Duncan of Penzance, and I have a very neat specimen, somewhat approaching it, from Scotland, for which I am obliged to my kind friend Gilbert Laing, Esq.

This variety is certainly rare, especially in fine specimens, and may be considered as one of the harder varieties of Malachite. The interior of the mamillæ is formed of compact radiated Carbonate of Copper of a darker colour.

At Dalehead-mine is also found the elegant satiny full green radiated Carbonate, so much prized, and chiefly known as of Siberian origin. I have indeed small specimens of it from North Wales; but hope ere long to figure a satisfactory one from Dalehead.

The gangue of this and the following specimen is a variegated Pyrites or Sulphuret of Copper with Quartz.

TAB. CCLXXX.

This specimen is remarkable, not only from its being unique, but from being found by Mr. Sheffield in Dalehead lead-mine, in Cumberland. The vitreous appearance might give occasion for dispute between the Neptunians and Volcanians; but as I consider both modes of formation to be more or less concerned in many instances where it has been imputed to one only, I shall leave it to every philosopher to consider it in his own way, as such a specimen may give equal force to either theory when considered alone.

This specimen consists of a green Oxide or rather Hydrate of Copper united to almost half its weight of Silex. It is quite vitreous or glassy in its fracture, with a semitransparency, full of irregular cracks or flaws, like the potter's glaze, or like moderately diluted gum that is cracked after being left to dry, and when thinnest, not unlike cracked varnish. Its colour and brilliancy are quite similar to verdigrise, which is only a preparation from Copper; nor do we know many other substances which produce this beautiful green, which in some intances approaches the green Patina found on old coins. Under the blowpipe its brilliancy is lost, and it assumes a dark brown colour, but the fragment is difficult of fusion. Small pieces thrown into dilute Nitric Acid gradually lose the Copper they contain without effervescence, and the Silex remains unaltered in form. Of two grains and a half, about one grain and a fourth remained transparent when wet, but proved opaque white when dry, and possessed the characters of Silex.

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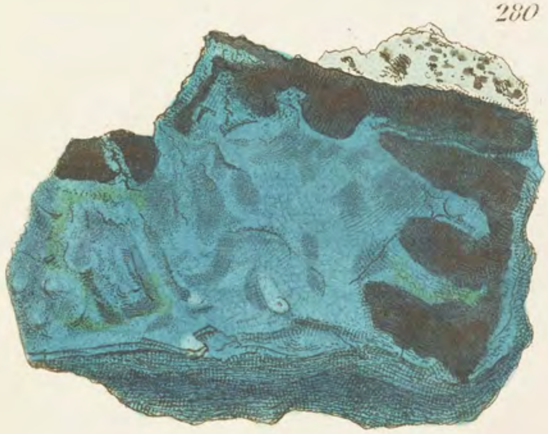

[illegible] Publish'd by Ja.s Sowerby London.

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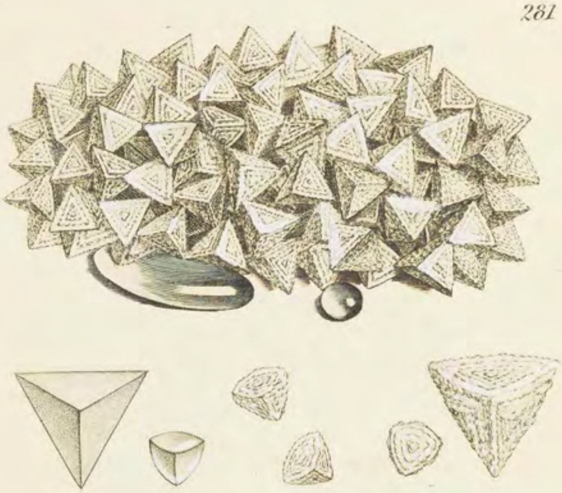


Oct. 1. 1808. Publish'd by Jas. Sowerby London.

TAB. CCLXXXI.

OXYGEN Aqua.

Water, Ice or Hail.

Class 1. Combustibles. *Order* 1. Homogeneous.
Gen. 4. Oxygen. *Spec.* 2. Aqua.
Div. 1. Crystallized.

GEN. CHAR. Permanently Gaseous. In all cases the supporter of Combustion.
SPEC. CHAR. In combination with Hydrogen.

I HAVE already introduced a subject from the skies, and it is not a little remarkable that it should be necessary to do so again, but to show the insulated crystal of Water I have no other resource. Indeed Water in any form may be deemed more absurd in British Mineralogy than the Meteoric Stone. As it, however, belongs neither to the Vegetable nor Animal Kingdoms of Nature, it must remain to the Mineral one, and this with the more propriety as its ingredients are found dispersed in that division. It has long been known that 85 parts of Oxygen Gas and 15 parts of Hydrogen Gas, combining at the expense of the greater part of their Calor, or the Galvanic or Electric Fluids, &c. form Water, and that this becomes solid, or Ice, at 32° of temperature, being liquid above that point. Hence it is mostly in the latter form that it is best known, such being the more usual temperature of the atmosphere, especially in moderate climates: in winter indeed it is often in the

solid state; but on the earth it does not appear to form itself into any distinguishable shapes or crystals, as it is mostly condensed, and dependent on adjacent subjects that are not favourable to equal, or what we call perfect crystallization, and being either in thicker or thinner plates, or shooting into rather undetermined spiculæ.—In the atmosphere, however, it is sometimes surrounded by a more equal medium, so that every side has an equal opportunity to form; and thus we are allowed to see the true shape of the crystal of Water with as much precision as that of an earth or a metal, nay, even more so than Quicksilver, which I believe has not been discovered. As the crystal of Water seems very undetermined by the authors I have examined, it gives me great pleasure in being able to show it. As hail, its crystals are in general rather opaque tetraëdrons, formed of roughish accumulated plates—see *the top and right hand geometrical figures*—but sometimes in smooth, somewhat rounded transparent tetraëdrons—see *the left hand figures*. Other forms have been seen; but these are mostly clusters of indistinct granula or spiculæ, or irregular solid masses, or both combined, as in the large hailstones that fell at Menabilly in Cornwall, as observed by my friend Philip Rashleigh, Esq., where the opaque, perhaps minutely crystallized granula were about the size of a pea, and enclosed in flattish irregular masses of ice, half an inch in thickness by an inch and a half or more in length or breadth.—See *Mr. King's Account of the Meteoric Stones*. Water is so useful in a fluid state, that neither mankind nor any part of the present mundane system could exist without it. In the solid state it is most quiescent; but at the temperature to which it is most liable to be exposed, in various seasons and climates, it proves a compound ever assisting in the grand scheme of the universe, as the cause of vegetation, beginning that life which is perfected in animals. It makes in most instanees the

greater bulk of the vegetative body, either disposing the foundation, and conducting the base or root, governed by the unfolding organs of the seed, to descend in due order; or the other parts to grow and ascend, helping the arrangement by a sort of natural union, and guiding the necessary particles to build the wonderful fabric. Since Water has been found to consist of three elements, viz. Hydrogen, Oxygen, and Calor, it has also been found to be soluble in the common air, in various proportions; in which case it is capable of acting either by itself, or in conjunction with the common air; so that the effects and changes to be wrought upon substances where this fluid comes in contact with them must be innumerable. Thence the many appearances that are otherwise unaccountable may be the more easily comprehended.

Water often contains various substances in solution, such as salts, earths, and even metals. Thus Epsom Salt, or Sulphate of Magnesia, Sulphate and Super-carbonate of Lime, Carbonate of Iron, or Sulphate of Copper, &c. are numerous varieties, and are commonly called Mineral Waters; but as they do not properly constitute different species of Water, one figure is sufficient in this work, unless the varieties of form in the crystals of Snow should warrant more.

Oct. 1. 1808. Publish'd by Jas. Sowerby London.

TAB. CCLXXXII.

CALX carbonata, *var.* Stalactitica.
Stalactitic Carbonate of Lime.

Div. 2. Imitative.

THE remarkably chimerical or whimsical appearance of the formation of this Carbonate is truly admirable and instructive, showing that Nature kindly indulging us with so many elegances for amusement, knowledge, and improvement, must excite the most lively sensation of gratitude in every sensible mind.

I consider this as a sort of gradation from the Carbonate of Lime with the usual rhomboidal fracture, to the hard Carbonate of Lime with the irregular or rather flinty fracture. Its fracture is rather curved and irregularly plated. It is somewhat harder than the former, and generally of rather more specific gravity. Sometimes the harder Carbonate of Lime —see *the next plate*—partly coalesces with it; see the opaquely tinted whiter parts.

The varieties of its forms are beyond description; and the manner of the curvature in every varied direction. Branching, and inosculating, is not only new, but rare in Carbonate of Lime, nor do I know that it has been before described. It must be observed that the Sulphate of Lime, *tab.* 21, however curved, is more involute, and otherwise varying. The specimen here figured differs somewhat in hardness: the more opaque parts, however, are in general hardest. It is mostly semitransparent, with a somewhat

waxy appearance, sometimes having a beautiful satiny or even pearly gloss, and showing occasionally some facets of small crystals. It seems to lead us through the mineral aggregation to the growth of plants, and hints to us their connexion, which is, however, more conspicuously shown in the next plate. I have called this chimerical, because we never see two specimens alike, and it seldom happens but that they convey, in the smaller or larger masses, an idea of something monstrous, not unlike some of the strange imaginary figures of the Chinese.

Oct. 1. 1808. Publish'd by Jas. Sowerby London.

TAB. CCLXXXIII.

CALX carbonata dura.
Hard Carbonate of Lime.

Div. 2. Imitative.

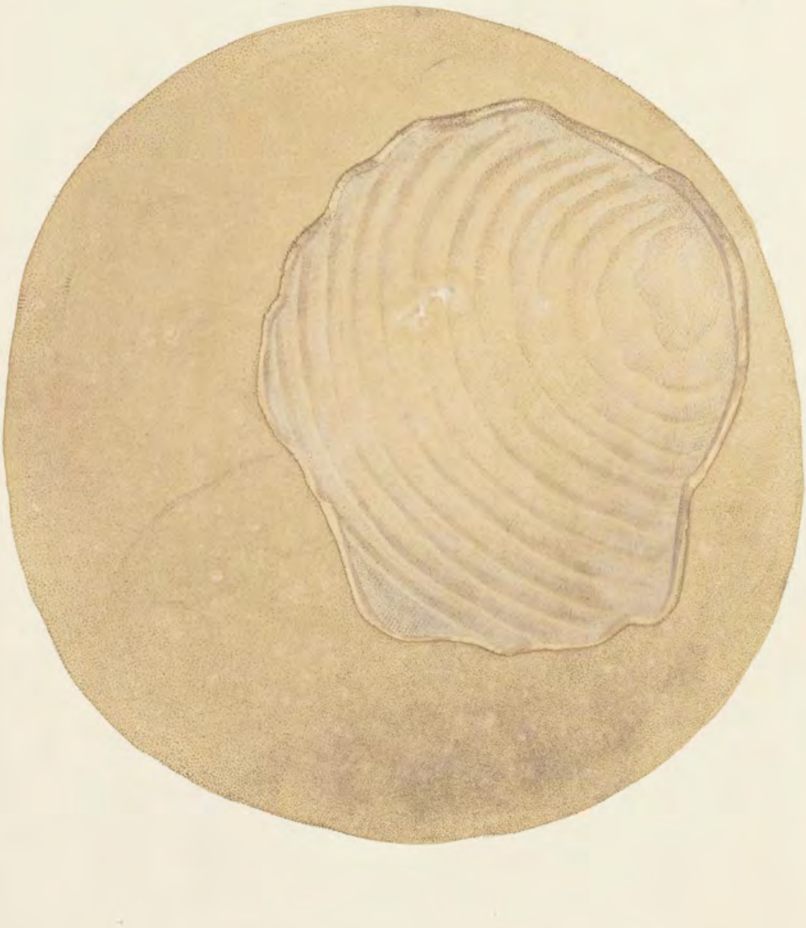
THE elegant specimens of Hard Carbonate of Lime from Eizenarzt in Styria have long been recognised under the misleading name of Flos-ferri. The no less elegant specimens of our isle lately discovered at Dufton in Lancashire are, if possible, more truly interesting to us, as a product of our own country, rich not only in the conveniencies of life, but in materials for that sort of instruction which teaches the ways of Providence, so that we cannot forget to adore the infinite wisdom which even provides for our curiosity, and thus proves an incitement to knowledge of the first utility. In this fossil we see so much of the vegetable, and even of the animal structure, that our astonishment is heightened beyond all common sensation.

The substance is a stone, though its formation is like that of a plant or animal. The *Agaricus tubiformis*—see *English Fungi, tab.* 382—or its variety, *Ramaria ceratoides*, often has as little resemblance to vegetation as this; and the *Sphæria digitata*—English Fungi, *tab.* 69—shows, when broken, very nearly the same conical and fibrous surface, or fracture, as this stone, as I have endeavoured to express, besides other analogies, whilst the coralliform appearance or structure of it has been universally acknowledged. The specimens I possess are so large and elegantly

formed, that they ought to be seen for any one to get a just idea of them *: but to proceed with the description as well as I may. It is very compact, with a partly conchoidal and somewhat splintery fracture, and more or less composed of fibres radiating from the axis with an inclination towards the ends of the branches, without any sign of the usual rhomboidal fracture of Carbonate of Lime. This texture continues throughout the whole formation, whether globular, curving, branching, or inosculating. The centre is generally most dense and opaque, and the outside opens into spiculæ—see *the right hand figure*;—other fresh spiculæ seem to be emerged as it were, and form a covering. Sometimes the outward spiculæ are very transparent, giving a velvety appearance in particular lights. Sometimes there are small grains of the equiaxed form of common Carbonate of Lime upon the surface, giving it a curious appearance—see *the lower left hand figure*.

Its gravity and hardness help to distinguish it. Probably its density may answer for these characters, as it effervesces with acids, and is dissolved very readily, like other Carbonates of Lime. The variety figured on the last plate will often form one specimen with this.

* Mr. Sowerby will most willingly show them to his friends, on the first or third Tuesday in the succeeding months of the year.



Oct. 1. 18[illegible] Publish'd by Ja.s Sowerby London.

TAB. CCLXXXIV.

CALX carbonata, *var.* fœtida.

Fetid Carbonate of Lime, spherical and concentrated.

Div. 2. Imitative.

Although this substance has been twice figured before, the present specimen is so remarkably curious as to its formation that it must excite astonishment, and I have found that the best description must fall short of giving a proper idea of it without the specimen or a figure. At first it seems a wonder that the spherical ball should be formed so regularly as in this, or so aggregated as in *tab.* 19; but the somewhat stratified concentric rings, with a sort of coat or covering, (as a formation of stone,) are at present unaccounted for in a satisfactory manner, any more than *tab.* 38, to which, however, some affinity may be traced. But as the formation is more external, and the inside partly crystallized, although somewhat confusedly, it is still more unaccountable. I broke one on purpose to see how it appeared withinside, expecting a section would either show a continuation of the concentric rings, either in striæ, or casing like an onion, or that I should be led directly to the manner of its formation; but as it does not show what was, or might have been, expected, it may be somewhat satisfactory if I try to account for it, although it may appear a little too theoretical.

On examining the broken one, there are some signs of a

crystallization radiating from a point, or centre, approaching in appearance the inside of *tab.* 38. Thus the substance consolidated chiefly as to its inside; but being in some parts of a more earthy fracture, there probably was much undissolved matter, which interrupted the crystallization, and so it is occasionally irregular in its appearance. Some parts of the outside, therefore, it seems, were successively covered with these rings, as the water evaporating, in the time of aggregation, allowed of them: afterwards the substance of the coat adhered less perfectly between wet and dry, not so easily attaching to the drier edges of the rings or circles: and this may be in part understood; for it is only where the coat easily separates that these circles are seen, and should we by a little help detach any other adjacent part of the coat, there is little or no continuation of them. Sometimes there are partially two or three coats, some very thin, and occasionally two or three balls are found adhering together with the circles on them. These stones are not always what are called Swine- or Stink-stones, some having little or no Sulphuretted Hydrogen, which I believe is the cause of fetidness in this particular species, though not in all Stink-stones.

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TAB. CCLXXXV.

CALX carbonata.

Crystallized Carbonate of Lime.

Div. 1. Crystallized.

At the commencement of the study of British Mineralogy I could scarcely conceive the beauty, novelty, and instructive utility of it in our own country; but every investigation of Nature's admirable ways is replete with the most satisfactory proofs of the necessity of such research, and the most exalted writers have been most indebted to it to give that universal celebrity that is attached to their writings.

"For thou, Lord, hast made me glad through thy work: I will triumph in the works of thy hands."—*Psalm* xcii. 4.

To those acquainted with the nature of crystallization and the formation of stones, this must be a curiosity. The elements composing and decomposing each other, according to affinity, are here displayed. While the Carbonate of Lime was forming according to its due course from one menstruum, another disturbed it; and thus it was diverted from forming an entire regular figure, as the metastatic, or its makle, and other additional facets are formed, some deeper than others, so as sometimes to give them an obliquity, and so to disguise the figure, and therefore it is difficult to trace the operation. The upper left hand side of one of the crystals shows most of these facets pretty completely, some of which are very shallow, but one is very sufficiently marked. This is only on one side, or the half coat of the crystal; for the interruption on the other side leaves the included metastatic crystal half exposed, whose faces are often seen roughened by corrosion. This coat often overlaps the edges, and finishes irregularly. It would seem that the

powdery white about the gangue has been precipitated, covering some, and filling other crystals, so as to appear as if filling a case—see *the lower right hand part of the figure.* This white part is granular, almost of the texture of Carara marble, but is more perfect in the following specimen.

TAB. CCLXXXVI.

THIS, and the last figure, have nearly the same form of crystallization, and also in some parts the appearance of Carara marble more complete, with a very white surface. Among the substances concerned in this composition or decomposition we find Sulphuret of Iron neatly coating the crystals, which are more perfect than those in the former figure, few having the corroded or half coated appearance; and so accurately does the Sulphuret of Iron fit upon most of them, that it could not have been discerned but that they were solid metallic crystals of Sulphuret of Iron, with a gold blued steel, or copper-coloured, appearance. These so complete coverings are very thin, and, when magnified, are found to be composed of minute bubbles, with the fine mammillated appearance of the bubbled fusion belonging to metals, although the effect of a fire to produce such a fusion would certainly have given opacity to the crystals covered with it, which the broken ones discover to be otherwise; that is, to be Carbonate of Lime.

I am obliged to my worthy and scientific friend the Rev. Dr. Jackson for presenting me with these remarkable specimens, from the Dimple mine near Matlock, which give a fine idea of the changes passing on, in darkness to us, although our excavations, when mining, may let in fresh agents to the veins or lodes, which may probably assist in them, and may sometimes, though unknowingly, be useful, or the contrary. It may, however, be worth a little attention, as in some instances it may be of great consequence.

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Oct.1,1808. Publish'd by Jas Sowerby London.

Sepr [illegible] Published by Jas Sowerby London.

TAB. CCLXXXVII.

FERRUM sulphureum.

Sulphuret of Iron. Hair Pyrites.

Div. 2. Imitative. Capillary.

WHEN we find a curiosity from its rarity and peculiarity invaluable, we may with great satisfaction contemplate its nature from a figure and description, first as learning that such a thing exists, and next as such a representation approaches nearest to possessing an object which only one or two can actually possess.

The specimen here figured was gathered by W. E. Sheffield, Esq., in Wales, and therefore truly British. We are indebted to the generosity of that gentleman for the use of the very delicate specimen. The extreme tenuosity of the fibres is only to be equalled by the spider's attenuated thread. The Pyrites shoots so like a spider's thread across the hollows in the Septarium, which is an argillaceous iron-stone related to *tab.* 61, that, as the specimen really had got some spider's webs across it, they were difficult to be distinguished. The web, however, would not bear the gentle breath of wind without being put in motion; but had it been less carefully kept, the real webs might have been the strongest. Some of the threads are so thin, that it is difficult to see the golden hue of the Pyrites; a few are thicker, so as to show it tolerably distinctly.

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Oct. 1. 1808 Publish'd by Jas. Sowerby, London.

TAB. CCLXXXVIII.

MOLYBDENUM sulphureum.
Sulphuret of Molybdenum.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. Molybdenum. *Spec.* Sulphuret.

GEN. CHAR. Spec. Grav. 7·400. Nearly infusible. Colour yellowish white. Capable of being formed into an acid.

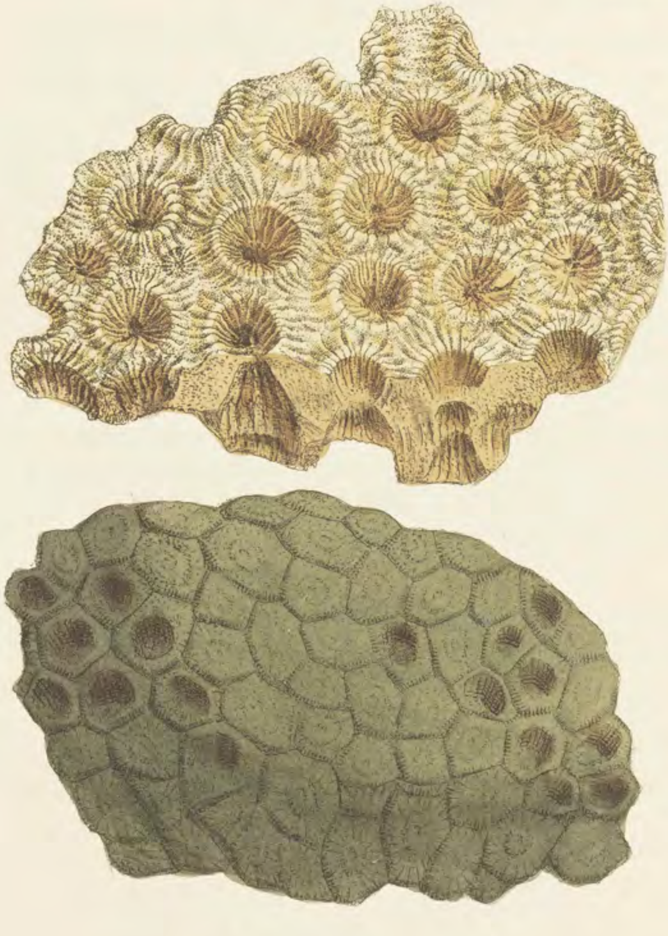
SPEC. CHAR. Molybdenum combined with Sulphur.

SYN. Molybdène sulphuré. *Haüy*, 4. 289.
Molybdène. *De Lisle*, 3. 4. *note* 3.
Molybdène sulphuré; Sulfure de Molybdène. *De Born*, 2. 119.
Warsserblei. *Emmerl.* 2. 541.
Molybdenite mineralized by Sulphur. *Kirw.* 2. 322.

THIS ore is said to have been found in Scotland. The specimens here figured are, *the upper one*, from near Menabilly in Cornwall, and *the lower one*, from Coldbeck in Cumberland, and are now first published as discovered in these latter places. Mr. Sheffield first told me of its being found in Cornwall; and Mr. P. Rashleigh was so good as to procure me a specimen about a twelvemonth since; and about the same time I had some specimens of rocks from Kendal, among which was the one figured at the bottom of the plate. The first is lodged in small detached parcels very sparingly in largely plated Chlorite or Talc, among

Arsenical Iron with some light Quartz; the latter in red Feldspar with Quartz and Mica, in which are interspersed smallish scattered particles of Pyrites, and the Molybdenum is dispersed in little particles, mostly on one broadish face, of a natural crack; but on the other sides of the stone, which is about half an inch thick, there is not the least particle to be seen. It therefore appears extremely local and partial. At first sight it has occasionally been confounded with Plumbago; but its micaceous foliated texture distinguishes it; besides, the lustre is truly metallic, and its colour bluer. Its folia are rather easily divided; it soils with less ease than Plumbago, and its mark is paler. It is bright in itself, and does not allow of being made brighter by scratching. I do not know that it has been found with determined crystals in Great Britain; I have, however, shown the form of the crystal proper to it. As we possess many things besides the few that I have published, that have been chiefly ascribed to foreign habitats, I shall be glad to add them to our list*.

* I intend to form a Supplement to British Mineralogy by publishing such few as do not seem likely ever to appertain to our island: see Advertisement on the cover.



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TAB. CCLXXXIX.

CALX carbonata.
Coral-like Carbonate of Lime.

Div. 2. Imitative.

WE read frequently with astonishment of vast Coral rocks in different regions of the globe, when it is only our negligence of the productions of our own country that makes us wonder, since every Limestone quarry and the adjacent places teem more or less with Corallines of various species, from Wiltshire to Yorkshire, Cumberland, &c., and even to Scotland and Ireland. Thus our island is almost all Coral rock externally, as will be shown, although some species are more local than others.

The specimen from which *the upper figure* is taken resembles *Madrepora radiata* of Solander and Ellis, *tab.* 47, *fig.* 8, but the artist seems to have forgotten the little intervening lamellated stellæ, or perhaps the specimen had not them. Gmelin and Solander do not mention any habitat. *M. cavernosa* of Espers Pflanzenthiere seems to belong to the same Coral. It has so exactly the appearance of a recent Coral, that it became quite necessary to show that it really was a mineral, in order that mineralogists may if possible be guarded in their conclusions, and examine further than the common external structure, however apparently decisive.

The organic appearance in this specimen is given by crystallized Carbonate of Lime, and is distinguished by its

fracture, and in some parts we see the stalactitical form of infiltration, as it were, into the exquisite mould formed by nature around the animal remains of organization. I was favoured with this specimen by Charles Stokes, Esq. It was picked up in Wiltshire.

The specimen figured beneath is very like *Madrepora ananas* of Solander and Ellis, *tab.* 47, *fig.* 6, said by Gmelin to be found in the Mediterranean sea, and in America, and frequently fossil. It is nearly whole, having been bounded by a sort of shapeless rocks when formed by the animal inhabitants. This is, if possible, more perfect than the last; but its dingey appearance might give us reason at first to suspect it to be the remains of some old Coral, for it has very little of the appearance of Carbonated Lime. It was sent me from Kendal Fell in Westmoreland.

The laminæ of the nuclei are often curved in these specimens, and more irregular than in the spines of Echini, which, as in those figured *tab.* 151 and 152, have them universally as regular even in the minutest of their parts as in the metastatic crystal.

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Dec. 1. 1818 Publish'd by Jas. Sowerby, London.

TAB. CCXC.

CALX carbonata coralliformis.
Coralliform Limestone.

Div. 2. Imitative.

DERBYSHIRE, Cumberland, Westmoreland, and some parts of Scotland and Ireland, have large remains of these coralloid Limestones, often called Marbles; which, when compact, being cut and polished, serve for tables, slabs, and other ornamental masonry. They vary much in colour, are of different stronger or paler reds, and sometimes the Madrepore is light with a dark or black ground; but I have some exactly the reverse, given me by Lady Wilson, from the north of England. Some specimens are of a larger variety, or a species nearly allied to this. Perhaps there are numerous species, as we have no reason to suppose there were not as many Corals formerly as now, and some are so nearly alike that we can scarcely determine the different species. The redder ones which I have by favour of Gilbert Laing, Esq., are found at Limeworth near Arundale in Dumfriesshire, and are often very beautiful; they are commonly called Bengang and Aboyne Marble. This is a larger species than that before described, and is lodged in red Limestone, which might be called Eisen-calk with as much propriety, by the Germans, as Quartz or Flint, coloured by red Oxide of Iron, is called Eisen-kiesel, and Clay under similar circumstances Eisen-thon. If the nomenclature is good, there ought to be such a concordance, when nature agrees with it.

I have given these examples to show some varieties depending on what is commonly called petrifaction, and also to show that the remains of organized substances have passed into the common soil from whence they in part originated, and are now become evident to us by the memorials left as proofs of such existence. In Limestone many curious subjects are to be found; but it is only intended here to give a general idea of them; and after showing a few other sports of Nature in different substances, it is expected that the remainder will be pretty well understood in mineralogical hands.

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Dec.1.1818. Publish'd by Ja.s Sowerby, London.

TAB. CCXCI.

SILEX Quartzum coralliformis.
Coralliform Flint.

Div. 2. Imitative.

This is one of the most beautiful, and perhaps local, of the Flint Coral formations, and is found in tolerable abundance in a field near Tidsbury, Wiltshire, in pieces, sometimes as large as a quartern loaf. Some specimens show the remaining form of a real Coral most perfectly; having at the same time little globular infiltrations, as if in the act of filling the spaces of the Coral with a whitish calcedony or cachalong-like substance, which more solidly pervades the Flint in other parts; and again a considerable part of the petrifaction is in so solid a state, that it retains a great degree of semitransparency, and either the reticulated or stellated structure; or both remain distinguished by the whitish opaque Calcedony, so beautifully, that it is one of the most curious subjects that I know of for ornamental jewellery. I have most of the varieties here figured as one specimen, but not on the same piece. Besides the stony representation of a Coral, perhaps new to our catalogue, there often remains the oval hole of the *Mytilus* or *Pholas*, which are known to bore holes in old Corals and various rocks.

I am obliged to my good and very generous friends, Thomas Mead and William Cunnington, Esquires, for most of my specimens of this curious modification of Flint,

and I have some specimens of Coral Limestone from the last-mentioned gentleman from Steeple Ashton, which have sufficient of the remains of the shell to discover by comparison that it agrees with *Mytilus lithophagus* of Linn. Trans. vol. 8, or the other new species, which I am inclined to think the cross-beaked one is, although the beaks are only a sort of accumulated appendage. I think it ought to be distinguished by some title different from the usual one, and might therefore be called *Mytilus curvirostris.* The signs of these, and innumerable remains of organization, seem to be the cause of the various spots in all common Flints, although they are often too much obliterated to show it, as it happens in some parts of the above specimens.

The Flint appears to have first entered into the substance of the Coral, and then seems to have been filling up the spaces between the ramifications, and is in some places to be detected in the operation; but some Flints have the general shape of a Coral, but not the least resemblance in other particulars. I have such as show what they are by the internal structure, from different parts of Wiltshire.

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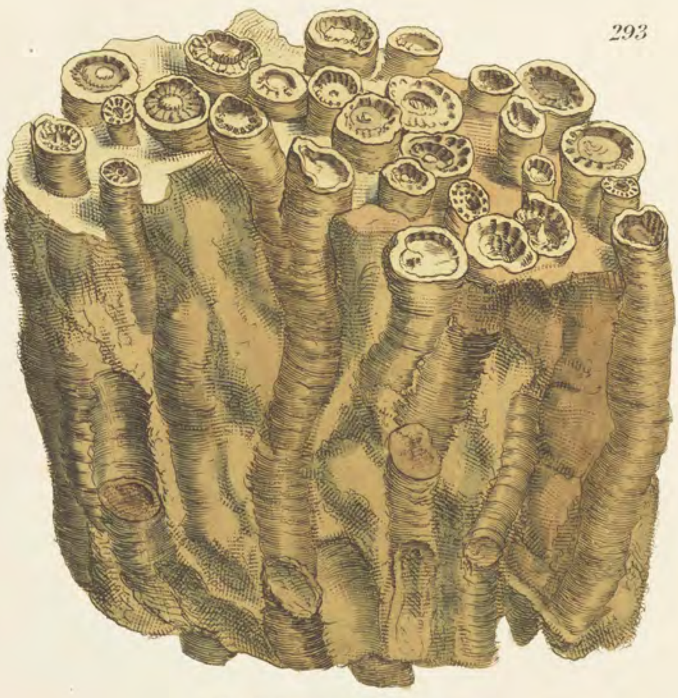

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TAB. CCXCII.

SILEX Quartzum coralliformis.
Coralliform Quartz.

Div. 2. Imitative.

HAVING shown some modifications in Limestone and Flint separate, it becomes somewhat necessary to show them in different substances; and the more so, as they have not been noticed by mineralogical writers. Varieties of the present sort of specimen have been taken for roots of different plants, as Ferns, &c. It is, however, another sport of Nature, forming the imitation of one substance which is imbedded in another. Thus the Coral is chiefly Quartz, and is imbedded in argillaceous Limestone. The Quartz in the polished piece is indicated by its taking a better polish than the Limestone; for what polishes Quartz grinds the Limestone, and will not give it a smooth surface; and the specimen having been thrown about as a boulder in the bed of some river, the Quartz is left beyond the Limestone, resembling stumps of plants, in many instances not much unlike stubble in a lump of earth encompassing the roots. I have received pieces from the shore of North Wales. This kind nearly resembles *Madrepora musicalis* of Linnæus, figured Esper 1. Madrep. *tab.* 30.

TAB. CCXCIII is another species, branching like roots dividing upwards, as happens in some plants, and the transverse section would accord with that notion to those not so conversant with Corals as with Plants; and in *tab.* 189 and

190 the divisions somewhat resemble the alternating lamellæ of the tribe of Fungi called *Agaricus,* a form that has given the name of Fungites to Corals, especially fossil ones. The cells concentrate, and the outside remains broken, much resembling some plants with decayed stumps. The specimen here figured somewhat resembles *Madrepora anthophyllites,* figured by Solander and Ellis, *tab.* 29, but the branches are not so club-shaped.

Dec.1.1808, Publish'd by Jas. Sowerby London.

TAB. CCXCIV.

BARYTES sulphata.

Sulphate of Barytes.

Div. 2. Imitative.

When we are showing any distinct subject, it is often necessary, for the sake of comparison, to exhibit others that bear analogy to it, and may be confounded with it. Frederick Hall, Esq., whose kindness gave me an opportunity of showing the best specimen of crystallized Carbonate of Barytes, *tab.* 76, favoured me with this specimen of Sulphate from Arkendale in September 1805. It now seems to be an appropriate time to exhibit this, and the pleasure I have in doing so may perhaps only be felt by those who occasionally share such friendly favours. It is, if I may use the term, a vermiculated Sulphate of Barytes, or somewhat like *Sabella rudis*, which accumulates bits of shells, as if an abundance of worm gluten, having accumulated every thing in its way, found chiefly Sulphate of Barytes to adhere to it. It is composed of irregularly formed tubes, many of which are distinctly angular with from three to five angles, the tubes curving and passing over each other in every direction in a crowded manner. When the present specimen was sent, Mr. Hall observed he could have sent a very large mass but for the great weight and bulk, it being as big as a bushel.

Primitive Crystals of Sulphate of Barytes are rather rare. These tubes are nearly covered with them both on the inside and out, the tubes being rather opaque. Those within

are smallest, and most irregular; of the outer ones some are nearly perfect, others slipped off, if I may use the expression; and the nuclei falling on each other somewhat irregularly are lengthened out beyond the proper angle; some are a little rounded, and some flattish; others have truncations on their angles, &c.—see *fig.* 1, 2, 3, 4.—and in some instances resemble the Pearl-spar, *tab.* 19.

I have a specimen that was in the collection of my late lamented friend Mr. Day, from Matlock, that has quartzose tubes which have much the appearance of the Coral, *tab.* 292, each surrounded by Cubic Fluor and Sulphate of Barytes in nearly lenticular crytals, like *tab.* 96.

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Dec.1.1808. Publish'd by Jas. Sowerby London.

TAB. CCXCV.

PLUMBUM Arseniatum.

Arseniate of Lead.

Class 3. Metals.	*Order* 1. Homogeneous.
Gen. Lead.	*Spec.* Arseniate.

Div. 1. Crystallized.

THIS new and at present very rare substance, but lately discovered in Cornwall, is a token of our possessing in our island some substances that are not found elsewhere. I am obliged to the Rev. William Gregor (who has been mentioned as the first person who analysed the Menachanite, *tab.* 277.) for ascertaining what this substance is, and also for the delicate specimen figured. In colour and form of the crystal it somewhat resembles Phosphate of Lead,—see *tab.* 84,—which, however, is seldom so brown as this, and is less transparent: besides, the crystals of Arseniate have some characters which I do not know to occur in the Phosphate of Lead, such as the fasciculated structure found in most of the crystals, even where the two ends are apparently regular; also a considerable degree of lustre, transparency, and neatness at the terminal edges: besides, it is considerably softer than Phosphate of Lead, and rather harder than Sulphate of Lead. The crystals are scattered upon a gangue of white Quartz.

With the specimen sent by Mr. Gregor, he favoured me with the following account, which, as it is likely to be very useful to the science, I consider it proper to publish in nearly his own words.

" The mineral which I lately sent to you was raised in a cross lode of Huel Unity in the parish of Gwennap in Cornwall. At what depth or under what circumstances I am unable to discover. A very small quantity only of it has been raised. I shall briefly mention some of the reasons which induced me to pronounce this fossil to be an Arseniate of Lead. A small fragment of it exposed to the flame of a blowpipe in a golden spoon loses its yellowish brown colour, and becomes white. Urged still further it melts into a brownish mass, and continues in this fused state without decomposition. If this mass be detached from the spoon and placed upon charcoal, and if the flame be directed upon it, a decomposition rapidly takes place, and fumes, evidently arsenical, are extricated. Globules of a fused metal are left upon the charcoal, which is marked with that yellowish hue which indicates the presence of Lead. This fused metal is malleable: it is soluble in Nitric Acid, and forms with it a crystallized salt, the solution of which is rendered turbid by a drop of liquid Sulphate of Soda, and a heavy white matter subsides. A piece of the mineral does not appear to be acted upon by Nitric Acid in the cold. By long digestion, however, in a sand-bath, the solution is effected. The transparency of this solution is not disturbed by a drop of liquid Muriate of Barytes. Some crystals, however, appeared in small quantity, after some hours, at the bottom of the glass. A drop of liquid Nitrate of Silver caused the nitric solution to assume an opalescence, scarcely however perceptible. The purest crystals were selected; but it is impossible to free them perfectly from all the stony matter which adheres to them. With a view to this extraneous increment, I weighed 26·2 grains, and exposed the powder in a platinum crucible to a very low heat, in which the bottom of the vessel was scarcely red, for half an hour. I proceeded thus cautiously, because the Arsenic Acid is decomposed under

certain circumstances, and it was a greater object with me to ascertain the quantum of acid than of the water of crystallization. The matter lost 0·48 of a grain. I have reason to think that all the water of crystallization was not expelled. It was now transferred to a silver crucible, and a ley containing about 20 grains of Potash was gradually digested with it, to dryness, and the crucible was at last exposed for a few minutes on an open fire. All the soluble part was elixated by distilled water, and the solid matter left behind weighed 19·50 grains. I found that the alkaline ley held a small portion of the mineral in solution: this was previously separated: it consisted of Oxide of Lead, Silica, and very slight traces of Alumina and Iron. After being neutralized with Nitric Acid, liquid Nitrate of Lead was dropped into it, as long as any precipitate was produced. The precipitated white matter weighed 14 grains, which, according to the calculation of Mr. Chenevix, indicates 4·62 of Arsenic Acid. In order to be certified that it contained Arsenic Acid, I decomposed it by means of half its weight of Sulphuric Acid. I obtained a dry granulated matter which attracted the moisture of the atmosphere. It had acid properties. Dissolved in water, it precipitated Oxide of Titanium from a solution of its Sulphate. Some of this acid was exposed to the flame by the blowpipe in a golden spoon: it bore ignition, and appeared to be a dry pulverulent matter; but being heated on charcoal it was speedily dissipated in copious arsenical vapours. Some of the Acid was neutralized by Carbonate of Soda. A solution of this Salt, mixed with liquid Nitrate of Silver, produced a copious precipitate of a *brick-colour*. As I thought it possible that all the acid had not been extracted, I boiled the 19·50 grains with a fresh ley of Potash. Some of the mineral was again dissolved, but not the smallest quantity of Arsenic Acid was obtained. The remaining matter was dissolved in Nitric Acid, except a small portion of Quartz. The matter, also, which had been separated from

the alkaline ley, was dissolved in the same acid. The solution was assayed by a drop of Muriatic Acid, which caused the precipitation of a white matter; but it was redissolved on shaking the fluid,—a circumstance which proves the absence of Silver. The Lead was separated by liquid Sulphate of Soda, and added together, the Oxide of which, according to calculation, amounted to 17·179. Ammonia afterwards precipitated a greenish white matter, a portion of which a further addition of Ammonia redissolved. The former proved to be Oxide of Iron = 0·17, and the latter Oxide of Copper which amounted to about 0·1. The Silica which remained undissolved by Nitric Acid, and which was separated from the Potash, amounted to 0·815. The Alumina was in too small a quantity to be estimated. This, and the Silica, and probably the minute portion of Copper also, proceeded, I believe, from the gangue of this fossil. There is a deficiency of 2·836, which is to be attributed in part, I think, to a retent of water of crystallization, in addition to the loss which is unavoidable in such experiments, more especially when small quantities are operated upon, and a repetition of experiments is precluded from the scarcity of the mineral."

Lead	17·179
Arsenic Acid . .	4·62
Water	0·48
Silica	0·815
Iron	0·17
Oxide of Copper .	0·1
Alumina and loss .	2·836
	26·200

Since the above was written, Mr. Gregor, having been enabled to extend his experiments, has informed me that he suspects the presence of the Muriatic as well as the Arsenic Acid in this substance, and that he intends presenting the Royal Society with an account of the results of his more extended experiments.

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Dec. 1. 1808. Publish'd by Jas. Sowerby, London.

TAB. CCXCVI.

FERRUM oxygenizatum argillaceum.

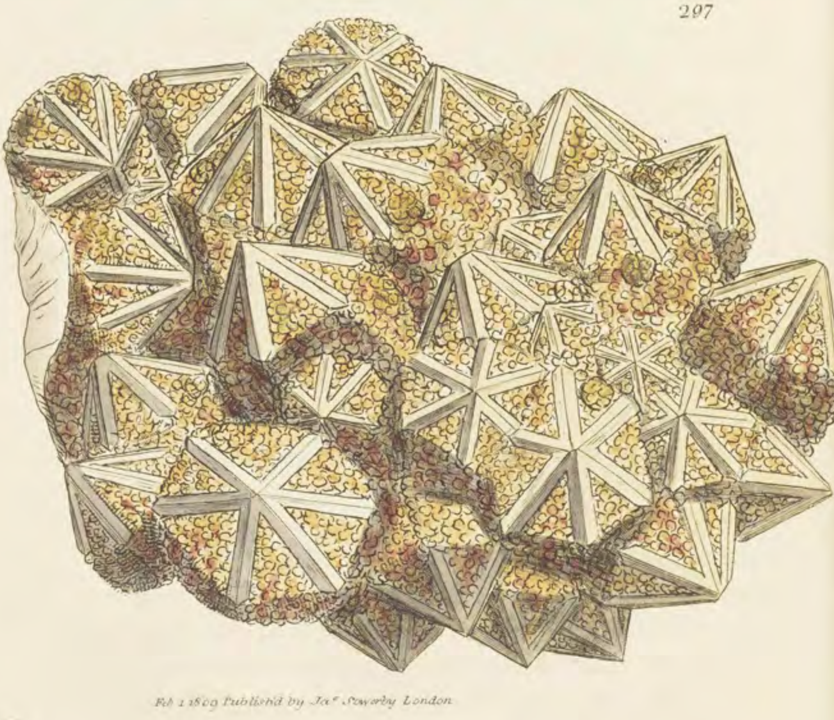
Argillaceous Iron-Stone.

Class 3. Metals. *Order* 2. Mixed.
Gen. Ferrum oxygenizatum. *Spec.* Argillaceum.
Div. 1. Amorphous.

Iron-stones with vegetable impressions, or rather exuviæ, have been much noticed by many writers, but have scarcely been admitted into mineralogical works: we should, therefore, be at a loss in most instances to find an account of them, where we would wish to see them spoken of as a part of the great system, especially of the phænomena of the change, or seeming conversion, of one substance into another. How bits of ferns or such plants should become so regularly immersed in the clayey Iron-Stone balls upon the Coal strata as they are found to be, can only be guessed at. They not only contain a certain portion of the plant, but often so regular a fragment that it would hardly be possible to put a more complete fragment between two pieces of clay, and press them into a ball, more or less ovate, as these generally are. Were I to endeavour to account for this appearance, I should suppose the plants to have been formerly in or near ferruginous loamy or clayey soil; that their tops being much shaken as by a watery or showery tempest, were continually beating against the unctuous clayey cliff, and thereby became loaded with clay, till the branch was detached by help of its cumbrous load; and being at length covered by the deluged soil, has remained to this time, a lasting memorial of a catastrophe of which we can only expect to see such signs, although it seems to say we are indebted to it for the Coal formation, which I think is more confirmed in these instances. The peculiar change here wrought is an excellent specimen to show us that, under these particular circumstances, all vegetables

then existing, however large or small, might undergo, by natural gravity, the changes that, as I have before said, preserve whole forests in the different forms of coals for the use of future ages. Thus the vegetable, in this instance, could but allow of certain of its most volatile parts, which gave it bulk when living, to pass into the clay, at the same time admitting of others to help the change. In general, Carbon and Bitumen are the ingredients of the remains, though sometimes it is nearly the same with that of a common brown dead leaf. The process of carbonization is occasionally carried on above ground, as in some Fungi—see *Agaricus Elephantinus, tab.* 36, and *aurantius, tab.* 381, *Eng. Fungi.* Dead leaves often become carbonized above ground; but the most frequent form of Carbon above ground is organic, as in *Sphæriæ*—see *Eng. Fungi, tab.* 372, 373, and 374, &c.

The observation that both sides of the impressions exhibit the same side of the leaf, is nearly correct. It seems that the front of the leaf is least liable to decomposition, and that the impression is opposite to it; the substance of the leaf, chiefly the front, remaining on the other half when it is detached. Only the inner side of the cortex, apparently, is seen, and I do not know that any signs of the fructification, which should be on the edge or other part of the back, have ever been detected, either in the impression or otherwise. *The two upper figures* seem to have been a *Pteris*, if we can guess by what remains. *The right hand one* is the concave impression, and the other the convex one that fitted it. *The lower figure* is a lobated fern, and is also, perhaps, a *Pteris*. It is lodged in rather irony clay, and has a coaly film in some parts, and small fragments of coal are among the squamæ. Some have much more coal on the leafy surface. Indeed the edges of some of my specimens have little hollows, and a margin of Carbonate of Lime and Pyrites, where the fruit may perhaps have been.



Feb 1 1809 Publish'd by Ja^s Sowerby London

TAB. CCXCVII.

SILEX Quartzum.
Crystallized Quartz.

Div. 1. Crystallized.

WHENEVER we wish to contemplate the wonders of Nature, we shall find ample scope for our researches in every branch of the creation. But subjects which are chiefly confined to œconomical inquiries do not so readily arrest our attention, as those which occur less frequently; and it is a grateful task, when opportunity offers, to indulge in admiration of the beautiful varieties that excite observations which might otherwise be lost or neglected. I am glad not to let the present object escape, as it is not only very remarkable, but also very instructive, being no where mentioned before. The singular crystallization, so conspicuous on the edges or angles of the pyramids, has so extraordinary an appearance, that it could not fail of being noticed by the miner; and its uniformity, over a much larger group than is figured, is a sign of its being originally extended very orderly, however the position of the crystals would seem to interrupt it. The parts of the faces between the edges are covered with innumerable eighteen-sided crystals in various positions, among which is scattered a large proportion of light-brown Pearlspar, giving a pretty relief to the whiter edges, which thus have a more star-like appearance.

The very curious modification of this crystal of Quartz, lately brought from Cornwall, being quite new to me, I could not but desire to have it shown. It often happens that the crystals of Quartz give some item of this sort of modification.

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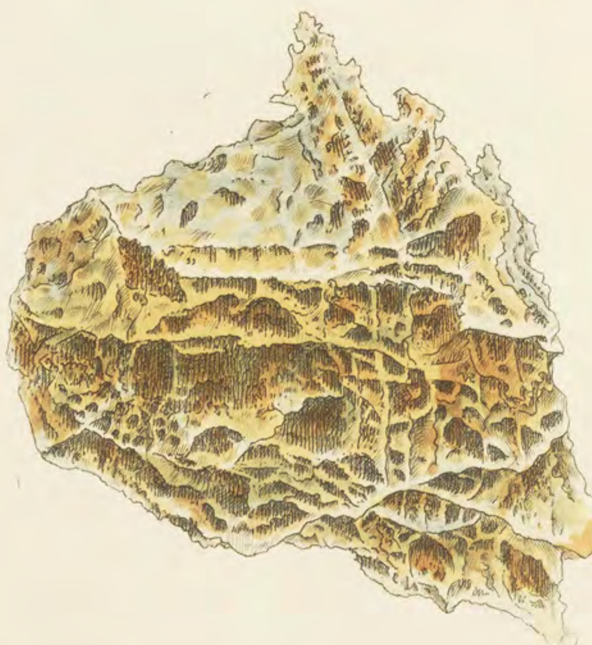


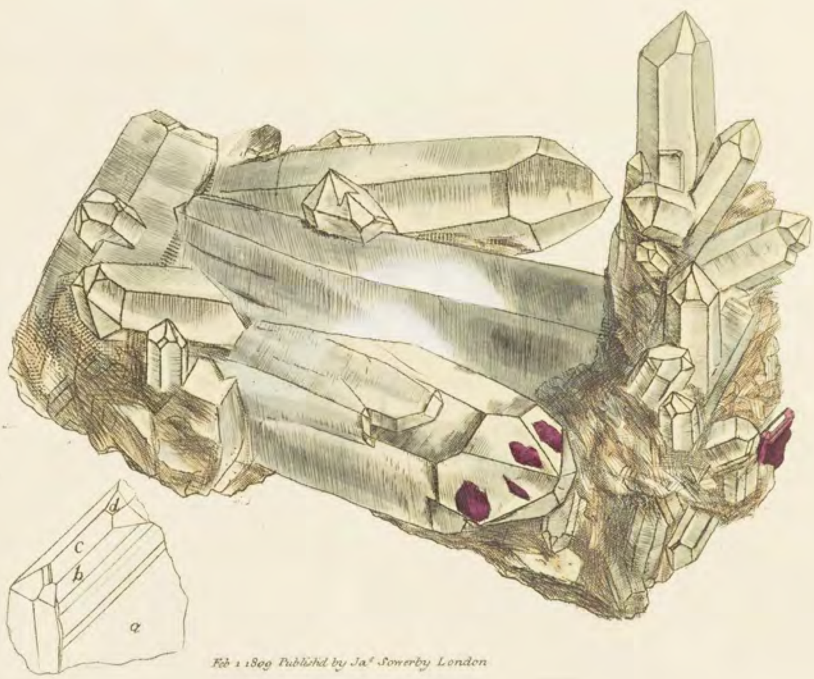
Feb 1 1809 Publish'd by Jas. Sowerby London

TAB. CCXCVIII.

SILEX Quartzum, *var.* spongiosum.
Swimming Quartz.

Div. 2. Imitative.

THIS curious formation of Quartz differs very much from the last, and is therefore essential to this work, as it could scarcely have been thought to be the same substance. Indeed it might have been imagined as great a miracle to see Quartz float in a large mass as the iron ax's head that Elisha caused to swim.—Masses of much larger dimensions than this now figured will swim, and scarcely displace the water. The present specimen is too tender to bear handling, and is thinner than any paper. It seems to have been formed in the interstices of some substance now entirely decomposed from it, which would appear to have had many thin cracks or flaws in it, crossing at various angles. I could not detect the cast of any thing regular about which it might form. I have some specimens very much resembling the crumb of bread.



Feb 1 1809 Publish'd by Jas Sowerby London

TAB. CCXCIX.

TITANIUM oxygenizatum.
Oxide of Titanium.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 22. Titanium. *Spec.* 1. Oxide of.

SYN. Schorl rouge. *De Lisle*, 2. 421. *Sciagr.* 1. 288.
Schorle crystallisé opaque rouge. *De Born*, 1. 168.
Spath adamantin, brun-rougeâtre. *Ann. de Chim.* 1. 188.
Titanerz. *Emmerl.* 3. 378.
Titanite. *Kirw.* 2. 329.
Adamantine Spar. *Kirw.* 1. 336.
Titane oxidé. *Haüy*, 4. 296.

GREAT BRITAIN is richer in Minerals than might have been supposed; and I am happy to have it in my power to add still another to the catalogue, by favour of my friend W. Lowry, Esq., whose kindness I have mentioned before. This gentleman brought it from near Snowdon last summer. When I figured the Menachanite, *tab.* 277, however confident I might be that many Minerals, as yet only discovered as foreign productions, might be added to the British list, I must own I did not expect to find *Titanium*, except in the Menachanite, where it is known, by the aid of chemistry, to exist in the form of an Oxide combined with Iron. The satisfaction of seeing it in a regular formation, distinctly identified and crystallized, is very grateful. It is most usually found in Hungary; but the present specimen more nearly resembles the specimens from St. Gothard, being on a gangue of Quartz and Adularia. I

do not know of any other having been found in Great Britain. It is of an intense semitransparent red, showing occasionally a brilliant reflection. The crystal is represented distinctly, and rather large, at *the bottom of the plate,* showing the principal faces deeply striated, with the bevelings, truncations, &c. The Quartz upon which it is found is rather elegantly crystallized and grouped; but could not be drawn with every advantage to show both subjects, and the white Adularia, which is in small crystals, somewhat like those in *tabs.* 211 and 212 in form, much resembling that found abroad, being nearly as transparent as the Quartz, which adds much to its rarity as being British.

Oxide of Titanium when crystallized is said to contain little or no Silex. Its specific gravity is from 4·1025 to 4·246. It is soft, but not easily scratched with a knife. The fracture in the present specimen is vitreous, nor could we discover any other, though Haüy says its primitive form is an upright prism with square bases. The most conspicuous faces of the largest flat crystal on the specimen are shown in *the lower figure,* the three angles of incidence that could be measured were *ab, bc, cd*; the first measuring 142°, the second 130°, and the third 147°.

There are many minute irregular fragments about the gangue, and two crystals remarkable for being flattish in the pyramidal end of the large Quartz crystal, one of which is reflected three times, or seen at the same time in three of the faces, which serves as an example of the multiplying quality of faceted subjects, very convenient in this where the substance is scarce. It is infusible by the blowpipe, but becomes blackish and opaque.

Since writing the above, I have been presented with a superb specimen of Quartz, on which are two or three crystals of this Oxide of Titanium, by my kind patron the Right Hon. the Earl of Dartmouth, from the same place. This specimen also has some Adularia about it.

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Feb. 1.1809. Publish'd by Jas. Sowerby London.

TAB. CCC.

FERRUM sulphureum.
Sulphuret of Iron, or Iron Pyrites.

Div. 2. Imitative.

AMONG other geological formations, perhaps, that are least noticed in works of this kind up to the present time, are those of fruits that are preserved in a Carbonaceous Pyrites, if I may so term the substance in which the Carbon, or remains of the Wood, is more or less incorporated with the Pyrites which has chiefly taken place of the Wood, like some parts of *the left hand upper fig.* &c.

The present specimens are from the cliffs of Sheppy Island, near Minster (whence the Sulphate of Barytes, commonly called Lepastrum—see *tabs.* 172, 173 *).

Many of these fruits fall to pieces from a certain excess of moisture which acts occasionally on this combination, by which many valuable specimens are lost from time to time. I was therefore glad to figure some while in a proper state.

The upper left hand figure represents a nearly round, semi-spined fruit with a flattish sulcus on one side. It is enclosed in a shell which is partly indented inwardly, opposite the spines. It is thick and irregular on the outside, and does not agree with any fruit now known.

The upper middle figure is a five-valved capsule.

The upper right hand figure is not much unlike the capsule of *Thea viridis*, but is less regular: nor does it agree

* I said, when those figures were done, that they were not found anywhere else; but I have since gathered them from the opposite cliffs at Southend, and have found small specimens at Sydenham in the Croydon canal.

with any *Euphorbia* so well as with *Menispermum*, Gærtn. *t.* 70.

In the second row *the left hand figure* is very different from any thing I know at present; as it appears to have had a fleshy capsule below a calyx of five divisions, and has within it a thinner woody capsule splitting in to five divisions.

The middle figure was not unlike some gourd seeds, but is now lost by decomposition.

The right hand one represents a flattish woody capsule, probably having had a fleshy outside.

The third row consists of three figures of a capsule somewhat resembling a hazel nut, partly covered with bubbled Pyrites. *The left hand figure* shows the outside; *the right hand one* represents the shell broken, as found, with a regular pentagonal seed within, which is shown more distinctly in *the middle figure*: this is occasionally found separate from the other part.

The lower line has in *the left hand figure* a seed or fruit similar to a nut, but the base has particular marks that do not agree with it.

The middle figure resembles the longish nutmeg, with the mace enveloping one side. On one part are protuberances which have a white Lime or Chalk upon them.

The right hand figure is a little like a half of a Kentish cherry with the stone; the outer part or mass is metallic Pyrites, formed as it were round the stone as from a centre, showing the peculiar construction of the fleshy part of a cherry.

Some of the specimens figured are in my own cabinet; with the others I have been favoured by Mr. Francis Crow of Feversham, who has a large and curious collection, of which I shall have an opportunity of saying more hereafter.

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SYSTEMATICAL INDEX

TO

VOL. III.

ALPHABETICAL INDEX

TO

VOL. III.

T

ADDENDA ET CORRIGENDA.

Page.	line.	
1 & 3	2 & 5	*for* oxygenatum, *read* oxygenizatum.
11	10	and *p.* 15, l. 17, *for* Felspar, *read* Feldspar.
28	6 & 7	*dele* "No. 2 was sent me with some others by my kind friend Colonel Walford."
30	8	*dele* "as they partly do."
	9	*dele* "into" *at the beginning of the line.*
47	24	*for* Sulfate, *read* Sulphate.
53	4	*for* Commmon, *read* Common.
57	18	*for* Schorle, *read* Schorl.
67	3	*from bottom, for* varety, *read* variety.
73	6	*for* Var. *read* Div.
79	*after l.* 1,	*insert* Argilla marga.
83	19	*for* others, *read* other.
89	5,	*for* 2, *read* 4.
101	*after l.* 1,	*insert* Quartzum Lithomarga.
107	26	*for* Eisen-thor, *read* Eisen-thon.
111	25	*for* oxidized, *read* oxygenized.
133	17 & 20	*for* Borrodale, *read* Borrowdale.
149	4	*for* being, *read* been.
155	16	*for* Schorle, *read* Schorl.
157		*add* "Gathered by W. E. Sheffield, Esq. in a lead mine near Craven in Yorkshire."
162	*last*,	*for* instanees, *read* instances.
175	14	*for* Warsserblei, *read* Wasserblei.
176	15	*dele from* "I have" *to the end of the sentence.*
179	7	*for* coralloid, *read* coralliform.
183	*last*,	*for* 189, *read* 289.
184	1	*for* 190, *read* 290.

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